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The Instructional Unit

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Those interested in shop curriculum and course construction will find this article on the function and composition of the instructional unit quite informative.

THE unit of instruction varies in name in different fields of education. Commonly known to many are units such as operations, jobs, projects, movements, and problems. In whatever fields units may be used, their function is to contribute indirectly to the realization of the aims of education. It is also their function to contribute directly to the aims of their respective subject-matter fields, and they constitute the course objectives. They are what the teacher should teach and what the learner should learn as a result of the teacher's instruction. Facilitation in learning should be gained by making immediate application an integral part of the teaching. The unit should be learned so well that the individual recognizes it when occasion demands its use; that is, the individual should be able to apply his knowledge; there should be transfer.

These units, then, are not unrelated to the larger whole of which they are a part. In arithmetic, where the operation serves as the instructional unit, the problem is the larger whole of which the operation is a part. In the shop, where the operation also serves as the instructional unit, the job — often called the project — is the larger whole of which the operation is a part. And just as in arithmetic, where the operation must be taught by the teacher, so in the shop the operation must be taught by the teacher. The manner of instruction may take many forms, but however it is accomplished, it is the duty of the teacher to do the instructing; it is not a matter of discovery on the part of the pupil. Discovery, or problem solving, enters the scene as another part of the learning process in which the learner appears as the leading character with the teacher playing a major supporting rôle. That phase will not be covered in this article. The title suggests that the instructional unit only will be discussed.

A Step in Curriculum and Course Construction

The determination of instructional units in a given subject, or trade, is a step in curriculum construction and course organization. The aims of education, and the aims of a given branch of education with its various subjects precede the determination of the proper units to be used. The units of instruction serve as the objectives — the daily objectives — for the pupils; they *are* the objectives of the given subject.

This process of discovering all the units of instruction, both manipulative and related, in a subject or trade is what we know as trade analysis. It may precede or follow the determination of aims but when the actual process of determining *what* units are needed, we are faced with the problem of knowing *what* we are trying to accomplish. The outcomes desired of the pupil should be stated first. Having stated the outcomes, or aims, expected in the given field, it is then the duty of the coursemaker to determine, by careful scrutiny, the particular units of the whole analysis which seems to fit the needs in terms of the aims. If the analysis has not been made, now is the time to make it. If training in analysis is lacking, advantage should be taken of the large number of analyses already available.* Analysis does not involve the grave difficulties suggested by earlier writings on the subject. It has become quite simplified even though now it offers difficulties to the initiate. A few suggestions may be of value regarding the composition of the instructional unit.

The Operation as the Basis

At the outset, it should be made clear that the instructional unit in manipulative shopwork should be based upon the operation regardless of what else it may be called. If both logical and psychological procedures are worthy of consideration, the operation should be adhered to as the basis of the unit of instruction. Larger units involve difficulties for learners in shop just as in academic subjects. In related content, the unit may vary in size depending upon the kind of related material. In technical related content, such as in arithmetic or drawing, which is assumed to aid the student in forming judgments, the units remain quite like operations. In the less technical or indirect content which is assumed to round out the learner's knowledge of a subject, but not necessary to the forming of judgments regarding performance on the job, the units may be considerably larger. The mining of iron, the process of logging, or the making of paper are such units. No great difficulty is encountered in determining these related units. The aims of the given field and good judgment serve in determining what nontechnical units should be taught. The determination of manipulative units, however, offers some minor difficulties which can be lessened by giving some attention to the accompanying suggestions.

Manipulative Processes

The operation is a manipulative process. It is the changing or shaping of materials just as an operation in arithmetic is the changing and combining of numbers into new units. Each manipulative process, or operation, should stand by itself as a unit and not as an ununified step. For instance, planing, or sawing, or chiseling are steps seemingly without unity and they are not operations; there is suggestion of ambiguity. Planing a surface, planing an edge, planing an end, sawing to

*The reader, if he has not already done so, should become familiar with the tentative analyses of the American Vocational Association. They may be obtained at 10 cents a copy from C. M. Miller, State Department of Education, Topeka, Kansas.

a line, or trimming a concave surface with a chisel are units; something is definitely done that contributes to a completed job. A number of such apparently complete units in themselves combine to complete a job just as in arithmetic a number of operations combine to solve a problem. We cannot teach just planing; it is too indefinite. We teach how to plane a surface, or how to plane an edge; which is more definite. Something is done which, when combined with other operations, completes a job.

Tool Usage as Analysis Suggests Ambiguity

The operation seldom takes the form of tool usage. Teaching how to use a tool also suggests ambiguity in shopwork. There are but few instances when teaching how to use a given tool can constitute a unit of instruction. The reason for this principle is that many tools in most shops are used in different ways on different operations, and several tools are usually necessary to perform a particular operation. Rather than to make indefiniteness in the analysis and resultant vagueness in the instruction, it is wise to think in terms of performance, and that the tools in whatever number are instruments needed in the performance. A chisel may be used in different ways in trimming and in making mortises and its particular use enters as one of the steps in the given operation.

Whenever a tool unavoidably appears in the analysis, it is wise to state its use in terms of performance. Such a tool as the marking gauge in woodworking is offered in illustration. Rather than to list the unit as "how to use a marking gauge" it would be consistent and retain parallelism with the other units by listing it as "how to gauge a line with a marking gauge." It would also take its place nicely with the units "how to thumb gauge" and "how to gauge with a rule." The principle of performance, rather than the use of tools, serves in all subjects.

Operations Accumulative

The operations in the elementary phases of the subject are simple. They should be the simplest units that appear in the analysis. The elementary operations are the simplest units to be taught and they should be placed at the beginning because they occur frequently in all stages of the work thereafter. They appear later as steps in advanced operations. Perhaps the clearest way to state this is to say that the operations become accumulative as the work progresses. This is a reason, too, for saying that the operation is the *basis* for the unit of instruction. This holds true in shop as in arithmetic. As arithmetic becomes advanced, the operations become accumulative; the advanced operations are composed of some elementary ones plus a new step or two, all of which combine to form a new operation. Cancellation is such a unit.

In shop, several elementary units combine with a new step or two to form, or shape, a more complex part. The teaching of the accumulated units involves instruction only on the new and untaught phase; the earlier and simpler units already having been taught, should not need repetition unless it is a matter of review. An illustration of a rather simple accumulated unit is "how to square stock." It involves "how to plane a surface," "how to plane an edge," and "how to plane an end" plus the remaining three steps. If the first three steps have been taught and learned previously, only the last three need be taught. "How to make and fit a drawer" is another suggestive accumulated unit of the more complex type.

Grade Level and Size of Unit

Does the grade level make a difference in the size of the instructional unit? The grade level makes a difference in the size of the unit only in its relation to the analysis; that is, a certain portion of the whole analysis should be used in a given grade and the lower the grade level, or accomplishment regardless of the school grade, the more elementary and the smaller the units should be; the elementary portions of the analysis should be used. There should still be unity in the processes rather than part units; and the principle that suggests avoidance of listing tools as units holds true in the grades just as in other and higher levels. We should remember that in the higher levels we advance toward the more complex units of instruction, whereas in the lower levels we are more limited and have as outcomes the learning of the elementary units which serve as foundations for further and more advanced learning in higher levels. Little advantage is gained by attempting to cover a whole analysis in a given grade.

There are good reasons for suggesting that in the junior-high-school grades, even the elementary units of instruction are too complex. This should be overcome in shop just as in academic subjects, when necessary, by not attempting to teach all of a single operation at once. Parts may be taught at intervals over a given class period, or even completed, in the next period if necessary. This principle is not necessarily adaptive only for the younger learners but it applies frequently to older learners as well. The adjustment of an instructional unit or part of a unit to the learners is a psychological process and therefore one requiring attention through good teaching. We must not assume that the analysis is impractically made if adjustment is necessary in class instruction. Individuals differ and we should constantly be on the lookout for occasions that need improvement in method of adapting instruction to individual differences and the best analysis will not provide variety in size of units that will be suitable for all persons.

Analysis-Making, a Subjective Process

The procedure of making an analysis of a subject or trade is a subjective process. It is seldom objective. It is made by individuals who, because all people differ, also differ in details when an analysis is made. But the general principle is always present — the things that should be known and done by the learner in a given subject should be determined and the foregoing suggestions will aid in making the analysis more objective. Another step in lending objectivity to the analysis is for two, or preferably more than two, persons to make the analysis; a coöperative procedure is suggested. Points can be discussed in terms of use and agreed upon. It is important, however, that all the individuals coöperating know how to make an analysis, because even one individual without knowledge of the principles of analysis will be a hindrance because of constant misunderstanding and consequent wasting of the time of others who must instruct in the rudiments of analysis, remaining tolerant at the same time. In fact, attempting a coöperative analysis without participants who are familiar with the principles and method of analysis is a hopeless task.

The Written Instruction Sheets

The instruction, whatever its form, should be based upon the operation, especially if the operation is to be taught by the teacher and immediately related to its application. There is little reason for making an analysis and then forgetting that it contains the instructional units to be taught. Again, it should be stated that the analysis contains the daily objectives that contribute directly to the aims of the subject-matter field and indirectly to the aims of education in general — if effort has been made carefully to match the aims and objectives. These objectives are the outcomes we expect to attain as a result of good teaching, and they are units that must be taught, if we really wish to attain the ultimate aims. If instruction sheets are used, they should contain in written form — and be better stated and organized — the instruction that would otherwise be given orally.

The query arises, How can the directions for the accumulated operations be written? They are written in the same manner as the directions for elementary operations. The directions for elementary operations have been written once and need only be mentioned when they occur again in instruction sheets for the accumulated units. Each sheet should

contain a unit which appears in the analysis and when necessary it should be separated into parts that serve as checking levels or "leaving-off" points so that the worry over the length of the period of instruction and application need not control the size of the instruction sheet. In fact, oral instruction also should be considered in the same way. We frequently stop at good "leaving-off" places and continue in another session. But the unit still remains whether or not it is taught in one session; it has been taught nevertheless.

An illustration of an instruction sheet written to conform to the suggestion just mentioned is one written on "How to square stock." This unit involves six steps. The sheet could well be written in six parts and at any time that one part, such as planing an edge, needs to be taught, just that part needs to be used; and any one of the six steps makes a good stopping place when time is limited. Such preparation of instruction sheets is quite necessary for the younger learners and exceedingly valuable for adults.

Summary

Determination of the instructional units to be taught is a step in curriculum construction and course organization, and as such it should bear close relation to the aims of education in general and to the aims of the subject-matter field. They are course objectives. The basis for the instructional unit is the operation and several suggestions are made especially for the initiate in analysis. The operation is a manipulative process and efforts to state the unit in terms of the use of tools suggest ambiguity in analysis and vagueness in instruction. The operations are accumulative and as such may offer difficulties in writing instruction sheets. However, suggestion is presented that should aid in overcoming difficulties in organization of instructions. The grade in which the units are to be used does not make it necessary to alter the analysis; it just alters the instructional process and the organization of instruction. The analysis of activities for discovering the instructional unit is a subjective process, and as such might well be undertaken by more than one person with a view to directing it toward objectivity. It is not a job for the individual who knows nothing about analysis. Since the operation is the basis for the unit of instruction and should be that part of the classwork presented by the teacher, the directions for it should also be written up and form the substance of the instruction sheet — if instruction sheets are to be used.

The Panel Discussion Method[1]

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The inadequacy of the usual convention speech is generally admitted. The method of carrying on a discussion as described in this article would assist greatly in achieving the objectives for which conventions are held.

IT IS becoming evident that the traditional types of programs provided at teachers' institutes and conventions are becoming less and less satisfactory.[2] The exigencies of the occasion usually prevent the opportunity for an exchange of ideas. The number of speakers, the shortness of the time, and the practice of following a stereotyped program pattern usually cut short all discussions. As is well known, however, the best part of a program frequently is the informal, spontaneous discussion which takes place in the lobby or some other place between friends who meet to "hash over" the contributions of the various speakers of a previous meeting.

Personal Reactions of the Speaker and Audience

How many times has one felt uncomfortable when listening to a particularly gifted and competent individual discuss a subject. The material being presented was good; nevertheless it was quite evident that the speaker was not familiar with the local conditions nor was he familiar with the amount of thinking or the progress already made on the problem by the group to whom he was speaking. It is a common mistake for the speaker either to overestimate or to underestimate the knowledge of his group on the subject at hand. Thus valuable time may be wasted in elementary development, or — equally disastrous — too much is assumed and not sufficient preliminary orientation is given.

Some speakers are particularly adept in adjusting themselves to their audience. They call for the raising of hands to signify assent or even ask direct questions of the entire group in order to get response by acclamation. However, the usual speaker comes "prepared" with a definite line of thought fully developed. Although his reasoning may be sound and logical, his audience misunderstands him by misinterpreting his illustrations The speaker, innocently and quite unaware of his failure, proceeds, only to discover too late that his audience is antagonistic, that his material has been misunderstood; and the net result is that the audience sinks into apathy or rises in more or less discourteous outbreaks of impatience.

The Round-Table Discussions

The "round-table discussion" is an arrangement that has been designed to provide the desired opportunity for the exchange of ideas among persons engaged in the same field of work. However, this pattern of program has been sinned against, and very often has consisted only of the reading of a series of papers. To be sure, there are printed in the program the name of the speaker and his subject, following which appears in bold type the word DISCUSSION. When the "speaker" has finished, the chairman opens the "discussion" by asking: "Are there any questions or comments?" All too frequently a dead silence is the only response. The chairman is then forced to go on to the next item, or else call upon members of the group to express themselves. Some chairmen anticipate just such unresponsiveness on the part of the group and attempt to insure a discussion by placing on the program a person to discuss the paper read by the previous speaker. Such a procedure usually results merely in having another paper read. It seldom results in an interchange of ideas or group thinking in which ideas are expanded or modified.

The Panel and Its Operation

These feelings of dissatisfaction with the various program patterns are common to most of us. It may have been our own experience perhaps, to have spent considerable time planning a program only to realize at the close of the session that the desired interchange of ideas did not materialize. Therefore it is with the idea in mind that any suggestions

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[1]Author's Acknowledgment; The author is indebted to the following for the general idea of the panel discussion method: (1) Dr. H. A. Overstreet, College of the City of New York; (2) Dr. S. A. Courtis, University of Michigan; and (3) Dr. Paul Rankin, Detroit Public Schools.

[2]For a brief description of various program types, see the Handbook *District Meetings of the Michigan Education Association Bulletin, 1933.*

along the line of a new technique may be welcome that we are willing to examine the merits of any new, though little tried, technique. It has been the writer's privilege to observe several demonstrations of the Panel Discussion Method.[3] It appears to offer almost unlimited possibilities for improvement in program making for discussion groups. Therefore the method is described, not with the idea of substituting it for all other types of discussion but rather as an additional method which may be used under certain conditions to obtain desired results.

The Elements in a Panel Discussion

The panel discussion method is a device to promote group thinking.[4] In the main, its principal elements are: First, there is a small group, not to exceed eight or ten persons, who constitute the panel proper. Second, there is a chairman of the panel. Third, there must be a subject which lends itself to this form of discussion. Fourth, there is an audience. All of these elements are of equal importance, and the whole scheme will not function if any one of the elements is not adequately provided. Therefore they are not named in any order of importance and the description which follows is not intended to overemphasize any single element.

For the purpose of making this description concrete let us assume that a panel discussion is to be arranged around the subject "The Maximum Size of Shop Classes." Such a subject lends itself to this type of discussion because all the information has never been collected. It is not possible to arrive at an answer, but it is highly desirable to bring out all possible points of view. The purpose of such a discussion would be to discover what conditions actually exist. Another object may be to discover whether existing conditions are unsatisfactory. The result of the discussion should indicate what group action is necessary.

The Selection of a Panel

There are many factors which affect the selection of persons to serve on a panel for such a discussion. It may be desirable to get geographical representation; therefore, school directors from an eastern city, a southern city, a western city, and a central city may be secured. In order to insure the teachers' viewpoint a shop teacher is included. Then, to get the school finance point of view, a superintendent is asked to join in the discussion. Because shop training, at least in some schools, prepares directly for industry, a man from some industrial organization who is familiar with the training of young workers on the job is secured to give his point of view.

Prospective panel members should be persons who are genuinely interested in the problem under consideration, who are alert of mind and coöperative of spirit, who are reasonably fluent of speech and whose voices carry well. In other words, the same reasonable care must be exercised in the selection of the members of a panel as in the selection of a speaker. Personality and ability are important.

In order to allow the audience to hear and see, the entire panel is seated in a semicircle behind a table facing the audience, the chairman in the center. The "rules of the game" prescribe that there shall be no speeches. However, it is necessary for the general chairman to introduce the discussion chairman to the audience, who in turn introduces the members of the panel to the audience. It is also necessary for the discussion chairman to state the question for discussion and briefly explain the general procedure. No member of the panel is permitted to rise to speak. There shall be no debate, no conflicts; instead, the spirit which dominates the discussion is that any and every view is a contribution and has a place in completing the thought pattern. After this brief explanation the discussion chairman sits down, thus bringing himself on a level with the other members of the panel. There must be no domination by the chairman of a panel.

The Characteristics of a Good Chairman

The chairman is the integrating agent. He opens the discussion by making a statement and putting a leading question to one of the members of the panel. A panel discussion well under way resembles nothing so much as a serious discussion of an important subject by a group of friends around a dinner table, except that an audience is present. The chairman suggests questions, interprets answers, harmonizes incipient conflicts, interweaves individual contributions into a comprehensive thought pattern, holds the panel to the topic and in general guides and directs the discussion.

At this point it might be well to emphasize that the chairman is a very important factor in a panel discussion. He must be a very resourceful individual. He must be able to harmonize and combine conflicting points of view. He needs to be very tactful and sometimes humorous so as not to offend those making irrelevant contributions, and to relieve emotional stresses. Above all he must be a person possessing an unusually broad background, a good general education, a photographic or retaining type of memory, and one who suggests calmness of temperament and graciousness of manner. He does not project himself into the discussion unnecessarily, nor does he offer very many ideas of his own. Rather, he confines his own contributions to restating, explaining, and relating the statements of the members of the panel. One purpose for this is to provide time for everyone to grasp the significance of the new contributions and allow time for formulating new thoughts for presentation.

The Selection of a Subject

The selection of a subject has already been referred to in its relation to the entire procedure. It can be seen that the topic chosen for discussion should be one requiring clarification, or about which conflicting or different views are held by the members of the panel. It should be specific in that it deals with a narrow, single topic, but it should be philosophical or general in its form of statement. The subject should be chosen first, and the personnel of the panel should be made up of persons competent to discuss the subject. A subject which is foreign to the interests and understanding of the panel should be carefully avoided.

The Part Played by the Audience

After an hour or so of discussion in the panel the chairman summarizes the discussion to that point and invites the audience to participate. Ordinarily this invitation is accepted by those who desire to have certain points clarified, to suggest new approaches to the problem, or to supply facts not yet introduced. The discussion then continues as before except that members of both panel and audience participate. The chairman still remains the unifying force, frequently restating the contributions, summarizing the progress, and calling attention to the problems which need more attention.

The Advantages of the Panel Method

Perhaps the outstanding advantage of the panel method is that the discussion, when properly conducted, develops individuals who can participate in coöperative thinking and achieve better solutions to many-sided problems. Another advantage is the high degree of participation. Both audience and panel feel that they have contributed to the final summary of the issue, and they have, therefore, contributed to progress. After all, the real goal should be the clarification of thought, especially to the end that it will lead the group to an understanding of each other's viewpoint and problems.

A well-conducted panel discussion should train not only the members of the panel but the audience in a higher level of coöperative planning. After all the highest level of planning is not done by one member of the group forcing his ideas upon the others. It should be the purpose to get all the information, all the points of view, in order to arrive at a better balanced understanding of the entire issue. After such a discussion the group realizes what the problems are and can set the necessary machinery in motion for the solution.

Preparation for a Panel Discussion

Although a panel discussion involves no set speeches and no prepared papers, it should not be assumed that preparation is not necessary. In the first place, the members of the panel should be informed about the general subject; in fact, no one should be placed on the panel who does not have both knowledge concerning the problem and a real interest in solving it. Then there are incipient dangers in panel methods.

[3] See Overstreet, Harry A., "Capturing the Depression Mind," *Journal of Adult Education:* Vol. IV, pp. 12–15; January, 1932. Also "Market Place for Ideas — An Exemplification of the Panel Discussion Technique" (a report of five actual panel discussions), *Journal of Adult Education,* Vol. IV, No. 3, pp. 240–284, June, 1932.

[4] Courtis, S. A., Articles on the general subject of group thinking. *Michigan Education Journal,* Vols. 9 and 10, also various numbers, 1930–32.

There is the control of the obstreperous individual who gets on the panel in spite of careful planning by the general-program chairman. Such an individual disregards the conditions under which the discussion is conducted and egotistically and aggressively insists on making a speech. Here again the humorous interruption of a skillful chairman, and the passing of the question on to another member of the panel usually prove effective. The fact that the chairman has the support of several of his panel and a majority of his audience should give him courage to deal rather severely, if necessary, with the individual who does not conform to the procedure.

If the individuals are especially talented, a panel can be assembled almost impromptu; however, it is usually considered better practice to give each prospective panel member some advance information. It is necessary, also, for the panel and the chairman to hold a preliminary meeting, usually just before their public appearance for an informal visit. The chairman must know each member of the panel by name, and he should know a few outstanding facts about each individual. The "rules of the game" should also be reviewed. In other words, the panel members must become acquainted with each other before their public appearance so as to be thoroughly at ease when the discussion opens.

Conclusion

I am presenting this description of the panel method of discussion because I have been impressed with and convinced of its possibilities in the development of group thinking and group planning. Incidentally, I believe our meetings in conventions and associations would be of more value if we had a better technique for conducting them so that there would be a more general exchange of ideas among the members. This material is presented with the hope that it will promote group thinking, group planning, and a better understanding of our common problems. The reader is urged to try a panel discussion in solving some of his local problems.

The Industrial Arts in Movies

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Using school-made movies to sell the school shop is a sure-fire method not as yet in general use. The authors describe ably how this method was applied in their school system.

THE purpose of this article is to recount some of the experiences which the industrial-arts department of the West Allis public schools had in producing movie pictures to be used in informing both school and community about the purposes, offerings and methods in industrial-arts work. It is hoped that the information given will assist others in deciding whether or not to use the motion-picture idea, give some ideas about the cost of taking the pictures, describe the equipment needed, explain how the work is done, and show what use is made of the film.

Some time ago, our industrial-arts department was asked to put on an assembly, which would portray the work carried on in our shops, before the students of the junior high school. A committee of shop teachers was asked to recommend how this could best be done. Among the recommendations made were: A talk before the assemblies, the presentation of a playlet which would convey the desired idea, the putting on of a practical demonstration, and the taking of movies of the work that is done in the shops. The committee finally concentrated on the last one and recommended that the motion picture would probably be the best vehicle to use because a great deal can be shown about what is actually going on, in a very brief space of time.

Although movies have been used for years in the shops as a means of augmenting the traditional methods of instruction, no one of our department had had actual experience in the taking of pictures. In addition to this difficulty, no funds were available for defraying the cost of taking the pictures. The first difficulty was solved when the co-author of this article kindly consented to give the project the benefit of his experience by advising the committee in the technical problems involved and to take the pictures. The first question to answer was how much would a 20-minute picture cost. This time was based on a 30-minute assembly, the remainder of the time was to be devoted to an introductory statement and explanation.

Cost Estimate

3 Rolls of Supersensitive Panchromatic 16MM film including cost of development (for pictures) @ $7.50 per 100 ft.	$22.50
2 Rolls of Positive 16MM film (for titles) @ $1.00 per 100 ft.	2.00
For developing titles @ $2.50 per 100 ft.	5.00
Postage	.25
Reel and Container	1.50
Cement	.50
Total	$31.75

The principal of the senior high school when approached on the question of allotting some funds to this project, agreed that it might have possibilities and he placed some funds at the disposal of the committee. This problem being solved, the next step was to determine what the film was to show and how many scenes were to be taken.

It was agreed that the film should give an idea of what the department was trying to do and how it operated to achieve its aims. The following activities were scheduled for filming, mechanical drawing, printing, woodwork, auto mechanics, machine shop, home mechanics, general metal and electric wiring. Certain guides were kept in mind as being important for getting best results:

1. Natural situations — unposed pictures are the most interesting.
2. Clearness — have pictures in balance, show as much as possible with each exposure. For manipulative processes closeups are best.
3. Coherence — have picture advance smoothly and logically. Guard against monotony by pleasing variations in successive points of view.
4. Correlation — show the correlation between departments for example: Mechanical drawing, patternmaking, and machine-shop practice.
5. Result — an interesting, attractive and intelligible screening.

With the foregoing principles in mind, each teacher planned a series of shots covering the work in his shop and prepared tentative titles for the takes or shots. The lists were gone over by the committee which made suggestions for their improvement. A schedule was then prepared which would make it possible for teachers involved to exchange work so that the picture could be taken during the regular class periods.

The following notice was then sent to the shop teachers:

MOTION PICTURE INFORMATION

1. Each shop is to have 10 shots or scenes.
2. Titles for the above are to be typed in the industrial-arts office. Turn them in to Mr. Erickson. He will check them and send them to the office.

SCHEDULE

Day	*Period*	*Shop*	*Teacher*	*Arrangements*
Mon. Nov. 7	8	Mech. Drawing	Mr. Erickson	
Tues. Nov. 15	1 & 8	Woodshop	Mr. Byerly	
Tues. Nov. 15	4	Auto Mechanics	Mr. Hughes	
Wed. Nov. 16	3	Home Mechanics	Mr. Schoenike	Mr. Van Duzee to take Mr. Stamm's class
Wed. Nov. 16	6	General Metal	Mr. Stone	Mr. Erickson to take Mr. Stamm's class
Wed. Nov. 16	8	Machine Shop	Mr. Knoblauch	
Thur. Nov. 17	6	Electric Wiring	Mr. Knoblauch	Mr. Erickson to take Mr. Stamm's class

Each group is to be ready for filming according to the above schedule, and will be guided in making arrangement by plans previously agreed upon.

The break of one week in the schedule from Nov. 7 to 15 was arranged for so that a trial roll could be taken.

Taking the Pictures

The camera used was a Cine Kodak F 1.9, the films Cine Kodak supersensitive panchromatic, and the lights the new G. E. Mazda photo flood lamps, with reflectors. The lamps operate on 110 volts and are rated 800 watts each. They may be plugged into ordinary home lighting sockets without special fusing and they provide a sparkling clear-cut picture. It is not necessary to bother with expensive and cumbersome equipment to get good results. A desk lamp or reflectors made out of tin may be substituted for regular reflectors.

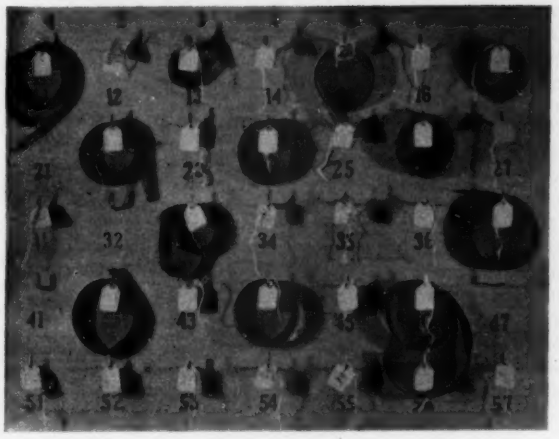
It was decided to take a hundred feet of film of the drafting room in order to try out the lights and determine the best distance to use for various kinds of views. To get a proper focus for the picture, sight the object to be taken through the view finder and move about until the view is suitable. Measure the distance from the camera to the object. The focus is then set accordingly. Lights are placed, on an average, four to five feet from the object using two new photo flood G. E. Mazda 110-volt 800-watt lamps. The first roll of film taken was immediately sent in and developed. From the results obtained in this film, certain variations in lighting and picture arrangements were made. Some of the shots had to be retaken. The results were uniformly good. All were taken at 1.92, with wide-open camera, and using full light.

The scenes having been taken, it was now necessary to take the titles. These had been previously typed, according to specifications as to spacing, capitalization, and size so that all captions would be uniform throughout the picture. The titles were placed in a frame in which the camera was fastened and they were shot in the regular manner on positive film. The time allowed was the time needed to read the title through slowly twice. This averaged two feet per title.

Editing the Film

Editing the film requires some technical knowledge and skill, an editing board, such as is shown in the accompanying illustration, and a splicing outfit. We used a regular Bell & Howell Co. splicing unit, and made an inexpensive editing board out of a discarded mechanical-drawing board. The surface of the board was laid out in 2½-in. squares. One and one-quarter inch screw hooks were then screwed into the board at the corners of each of the squares. The hooks may be purchased at the hardware store for 5 cents a dozen. A total of 70 were placed on the board which provides ample room for splicing a 400-ft. roll of film.

A 1¼ by 2-in. tag was placed on each hook. These are used to identify each title and scene. They may be obtained from a stationery store at a cost of about 20 cents a hundred.



The editing board

The easiest and surest way to edit a film is to plan the titles and scenes to be taken, then place the title number and scene name and number on the tags and finally place the tags on the hooks according to their sequence.

The films are examined over a light with the aid of a magnifying glass and the cuts made. The various scenes and titles are then placed on their proper hooks. For example: Title 1 is put on hook 1, scene 1 on hook 2, title 2 on hook 3, scene 2 on hook 4, and so on. A No. 3 paper clip may be used to hold the rolled-up film together. When it is not necessary to change the order of three or four successive scenes, for instance, 4-5-6, all of which follow title 3, these may be rolled into one roll and placed on hook 6. If it is necessary to leave the rolls on the board for some time, rubber bands may be stretched across the hooks to hold the rolls of film in place. The board should be covered (a newspaper works well) to keep the dust from collecting on the film. A container of water should be left near the board to keep the film moist so that it will not become too brittle and crack in the splicing process.

Splicing the Film

The film should be handled by the edges and care should be exercised so as not to get oil from the hands on the film; it spoils projection qualities.

1. Examine the film, turn it right side up — natural in scene.
2. Turn so that emulsion side is up.
3. Scrape off the emulsion. This may be done with a razor blade or a sharp instrument. Do this thoroughly as there must be celluloid-to-celluloid contact so the cement can take hold.
4. Apply cement to splices.
5. Join and press together.
6. If the film gets oily from the hands and collects dust, the oil and dust may be removed by running the film through a soft cloth saturated with carbon tetrachloride.

When the splicing is completed, the film may be run for proofreading and timing.

How the Film Has Been Used

The film and the talk that is given in connection with it has been put to far greater use than was originally intended. It has been used:

1. To show boys who were completing their required shopwork in the junior high school what shopwork is offered in the senior high school.
2. To show teachers what is offered in industrial arts as vocational- and educational-guidance help for students.
3. To explain to principals the purposes, scope, and methods used in the industrial-arts departments.
4. To inform the general public through the civic clubs, parent-teacher clubs, and other interested groups about a phase of edu-

cation not commonly well understood and to explain the importance of this work in the education of young people.

Results

Through the use of this film the students, teachers, citizens of West Allis got first-hand information about industrial-arts work. Besides this, many misconceptions have been cleared up because the picture is preceded by a talk which gives a historical statement of the origin, development, and present status of this type of work. Not only are the objectives of the work carefully stated, but the film also shows how these objectives are attained in actual practice. Besides all this, valuable publicity has been given the department by local newspapers which carried stories concerning the picture.

Exhibits and Contests

J. I. Sowers

Director of Adult and Prevocational Education, Miami, Florida

This article shows what excellent results follow from giving publicity to the work done in the school shops. Combining the exhibits with a contest helps student, teacher, and school in achieving worthwhile results.

ANNUAL exhibits and contests have served well for several years, and have done much in motivating the shopwork in Miami schools. The contests are held in connection with the exhibits during the last week of school. Two silver loving cups are offered by a local hardware merchant, one for the best work done in the shops of the junior high schools, and the other for the best jobs produced in the senior high schools. This past year the Miami Edison High School won the cup for the best high-school exhibit, and the Andrew Jackson Junior High for the best junior-high-school exhibit.

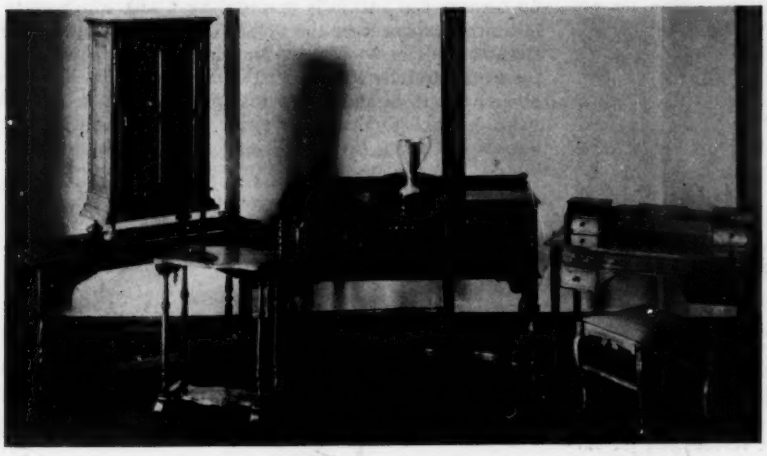
Aside from the cups to the schools, the local Rotary Club awards the best individual work in each of the grades from 7 to 12; that is, in each of the junior- and senior-high-school grades, a gold medal is awarded to the boy producing the best work during the year. "Certificates of Award" are conferred for second- and third-best exhibits by individual students in each of the six junior- and senior-high-school grades. Similar contests are also held in drafting and architecture.

These annual contests have done much to interest the public in the industrial-arts department of the schools, and to stimulate the work of the students, and to generally upgrade the kind and the character of their work.

This group is a part of the exhibit from Miami Edison High School. This school won the silver loving cup for best work in the annual exhibit of Dade County schools. A few pieces of a hand-carved Spanish dining-room suite are shown in this picture. The work shown here is made of oak.

The industrial-arts teachers of Miami meet one evening each week, 7:30 to 9:30, for the greater part of the school year for special instruction in their work. In these classes

This is a mixed group from a number of schools. Some of the pieces here are made of Maderia, a local wood of the mahogany family very beautiful in coloring and fine in grain. The pair of hand-carved bellows are rather nicely executed but do not show to advantage in the picture.



This group is also from the Miami Edison High School. The work shown here is made of Philippine mahogany. The Sheraton writing desk shown in this picture is a masterpiece of classic designing.

shop organization and management is taken up, but most of the time is devoted to instruction in the crafts pertaining to the work carried on in the schools. Wood carving, upholstering, inlaying, wood finishing, etc., are taken up in these classes in order to enable the teachers to do a better and higher grade of work. These evening teacher-improvement classes do much in promoting teaching ability, and skill among teachers. The classes deal directly with the week-to-week problems of the teacher, and assist him in acquiring the skills in which he may be lacking. The annual exhibits demonstrate clearly the results which these teacher-improvement classes bring about.

It is, of course, unfortunate that the intangible values achieved at school cannot be shown, and yet these are the real values for which the teachers are striving, and it is these values that affect the life of the student. The table and the chair which the boy produces in the school shop, are only incidents in the educational process.

Linoleum and Para Blocks

Clyde A. Crowley

Sabin Junior High School,
Chicago, Illinois

The author not only shows how linoleum and para blocks may be used in the printshop, but he also explains how the blocks may be cut.

LINOLEUM and para blocks may be used in the school printshop for cutting ornamental initials, posters, embellishers, and illustrations in one or more colors, as well as to reproduce signatures, charts, graphs, ornamental borders, decorative envelope linings, flash cards for the kindergarten and lower grades, book plates, cover pages, and numerous other ornamental and practical printing blocks which otherwise would not be available because of excessive cost. The making of these printing blocks not only serves to correlate the work of the art department with that of the printshop, but in addition it opens new channels of expression to the student which he may use according to his native ability. The extent to which this correlation may be carried out is limited only by the care and judgment used in planning the printshop course.

Adapting the Design to the Medium

The limitations imposed by the medium itself are not nearly so great as it is generally supposed. While fine lines and delicate shadings in relief are almost out of the question with the ordinary variety of battleship linoleum, the harder para blocks and the finer grained and less porous grades of battleship linoleum may be engraved to a fine degree of accuracy without seriously weakening the printing surface.

In adapting a design to linoleum it is well to bear in mind the advertising statement of a leading paper house, that is, "Paper is part of the picture." Many of the most striking block prints are made up mainly of white space. The book plate shown in Figure 1 illustrates this well-known principle of design. Needless to say, any lettering on such an illustration must not be too rigid or formal. The crudeness of the letter formation in the illustration mentioned above not only adds to but harmonizes with the informality of the subject.

Methods of Treatment

The silhouette or relief form of design which is used in Figures 1 and 2 is by far the easiest for the beginner to reproduce. Many interesting studies may be produced by this form of presentation. A project which never fails to arouse interest and produce results which are readily appreciated is the production of silhouettes of persons known to the pupil.

A snapshot or photograph — side view — of the person whose likeness is to be reproduced is placed face up on the carbon or transfer side of a sheet of carbon or other transfer paper. The facial and head features are then traced with a sharp-pointed hard lead pencil, thus producing a reversed outline on the back of the print. This reversed outline is next traced on to linoleum and carved. The results, even in the hands of a beginner, are surprisingly accurate.

The intaglio method of engraving in linoleum is the most versatile. Fine lines and detailed shading can be engraved into almost any grade of linoleum by this method. Figure 3 is a reproduction in linoleum of a drawing by Aubrey Beardsley. Figures 4 and 5, a combination of relief, intaglio, and line form of illustrations, show effectively how something may be left to the imagination or implied by a few lines in both black and white space.

In producing designs with lines, great care must be exercised in the engraving process to avoid the breaking down of the printing surface under printing pressure.

Fig. 1. The relief form of design which is easy for the beginner. Fig. 2. The silhouette design. Fig. 3. This is a reproduction in linoleum of an illustration by Aubrey Beardsley taken from "Le Morte d'Arthur." Figs. 4 and 5. Combination of relief, intaglio, and line form of illustrations. Fig. 6. Not a self-portrait — just one of the writer's bookplates. Fig. 7. Another bookplate. Fig. 9. This graph was made by a combination of type, rule, and a linoleum block. The rule and type matter was printed over the linoleum print. Fig. 15. Ornaments are frequently useful in printing.

It is not to be assumed that these three treatments are all that are possible. Black backgrounds may be shaded with lines, following the well-known wood-cut style, screened effects may be produced, and any or all of the aforementioned methods may be combined to produce the desired results. The addition of color blocks and tint blocks also opens up a field of almost unlimited possibilities. Figures 6, 7, and 8 may furnish a few additional ideas as to treatment of design. Figure 8 is a two-tone print. The clouds were printed in gray and a second block containing the outline was printed over the first.

Charts and Graphs

Charts and graphs such as are used in statistics and analytical studies may be produced in a large variety of forms. By combining a type form with linoleum blocks either by overprinting or mortising the block a wide variety of intricate charts and graphs may be produced. Figure 9 is fairly repre-

Fig. 8. A two-tone print

sentative of the possibilities to be expected by this means. The use of metal type and rule overcomes the limitations imposed upon small lettering and hair lines in linoleum. By this combination many statistical charts, tabulations, and graphic studies may be reproduced.

Many physical principles and scientific analogies also may be effectively pictured by using a key block and an additional block for each color, substance, or movement to be shown. Figure 10 was printed from two blocks. The black (key block) was first printed, then the tint block (gray) showing the varying fluid level was over-printed. Although either block could be printed first in producing this type of illustration, it saves considerable time to print the key or outline block first. Remaining blocks may then be retouched to fit the outline accurately. The student who is inclined to mechanical rather than to free-hand drawing very readily takes to the making of this variety of illustration.

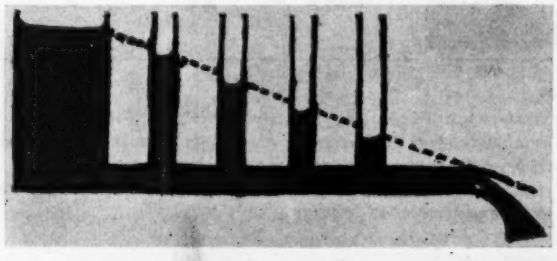


Fig. 10. A typical two-tone illustration of a scientific principle. Such charts may be printed in any number of colors and tones to illustrate the action of machines, processes, and principles. One cut is required for each color or tone value

Figure 11 shows a chart illustrating the type characters frequently confused by the beginner in printing. This was printed from a linoleum block.

Lettering in Linoleum

Figure 12 shows a few letters from alphabets that have been selected for block cutting because of their bold-faced design.

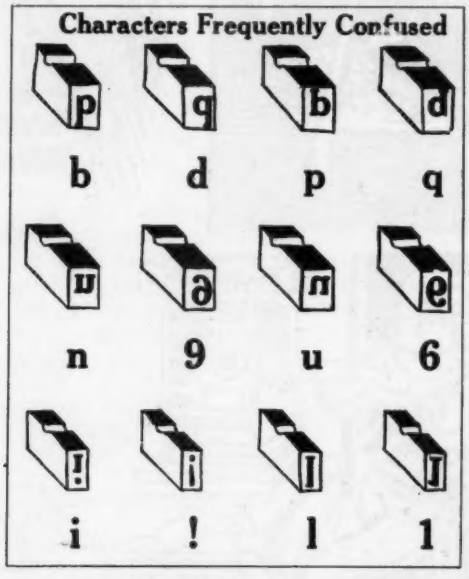


Fig. 11. Charts of this variety are easy to produce in quantity and are timesavers to say nothing of their efficiency in the technical classroom

Although a skilled artist can carve the straight-line gothics with a high degree of accuracy, the beginner will do well to confine his efforts to letter forms rich in broad curves and bold shadings. The ornaments and initials included in the chart will give some idea of the possible methods of treatment and their respective results.

The style of lettering should be selected with consideration for the idea to be conveyed and the characteristics associated with the styles of lettering. Text faces, for instance, may be used to suggest antiquity, skill, and ornateness; bold-faced gothic, strength and durability; shaded Roman faces, style; fine-lined italics, delicacy and sensitiveness; and the Roman faces, novelty, syncopation, and freedom; while the stately old-style Roman characters radiate an atmosphere of conservatism, dependability, and stability.

Making the Tracing

The first operation in the production of a linoleum block is the making of a tracing from the original drawing or sketch. If the original artwork has been made on thin paper especially for the purpose, the first operation in making a suitable tracing is to reverse the drawing. The simplest method of accomplishing this is to lay the sketch on the carbon or transfer side of a piece of carbon or transfer paper. Next, trace the drawing or sketch with a sharp pencil or stylus, thus producing a reverse copy of the original on the back of the drawing. Next, place a piece of carbon or transfer paper, transfer side down, on the linoleum block. The red transfer paper is superior

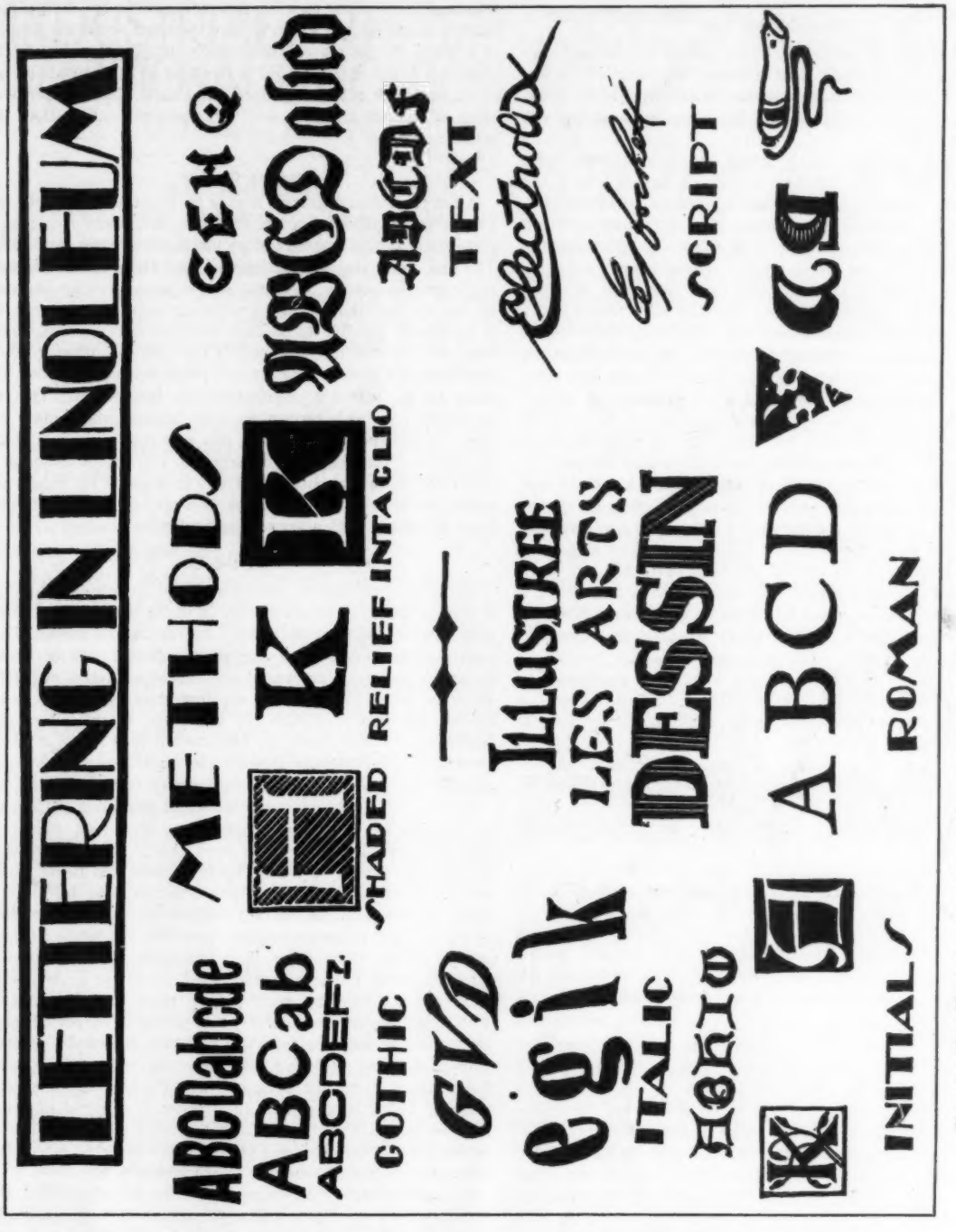


Fig. 12. This illustrates the styles of lettering that are best adapted to the linoleum carver's medium. The entire chart was carved into linoleum by the writer

to the blue or black carbon paper commonly used, as the red line is more plainly visible and does not rub out as quickly as the carbon line. Upon the carbon or transfer paper, place the original sketch with the reverse image up and securely fasten it down with thumb tacks, paper clips, or masking tape. Care should be taken to place the thumb tacks, if such are used, in a portion of the linoleum which is to be cut away. They should also be placed in such a position that they will not interfere with the hand during the tracing operations. The transfer to the linoleum should be done with care, avoiding excessive pressure from the pencil or stylus, as otherwise marks may be left in the linoleum which may show on the final print. When the tracing has been completed, remove the bottom thumb tacks, clips, or masking tape, and lift the original drawing carefully, noting any omissions or imperfections. By following this precaution, corrections may be made without having to reregister the tracing. When the copy has been satisfactorily transferred to the linoleum, remove the original drawing, carefully avoiding smears from the tracing paper.

Skilled workers frequently make the original drawing directly on the linoleum. With some practice even lettering can be done in reverse. If the cut is to be very detailed or the linoleum is so dark in color as to make the pencil lines difficult to see, a thin coat of show-card white or tempera color may be applied over the surface to make the drawing or tracing stand out more distinctly. When the cut is complete the remaining color may be removed with a damp cloth.

Engraving the Cut

The tools used in carving linoleum blocks are the ordinary gouges and veining tools used by wood engravers. It is important to keep a fine razor edge on all of them. Many a cut has been spoiled or depreciated in value by a tearing cut from a dull tool.

Relatively fine lines can be made with a sufficiently solid base to insure a large number of printing impressions if the engraver is careful to leave a slanting counter, as shown at *a*, in Figure 13. Avoid making the straight cuts shown at *b* and the undermining cuts shown at *c* in Figure 13. Although the straight cut may not break away entirely from the burlap base, it is almost certain to move back and forth with impression, thus preventing close register and producing a smeared print. The undermined cut will break down under the least pressure necessary for impression, and thereafter will not print at all or it will smear. Where fine lines are close together, they may be separated by a shallow cut with a veining tool. Where a considerable amount of blanked-out surface appears next to a fine line, the cut must be made deep enough to prevent spotting from the rough blanked-out surface. The greater the width of the blanked-out surface next to a fine line, the greater will be the printing pressure on the line. Figure 14 clearly illustrates this. Surface *b* contains only one fine line but it must support the same pressure as surface *a* which is solid. If the area of the solid surface is ten times as great as that of the line, that line will have to support a pressure ten times as great as would an equal surface on the solid. For this reason, it is obviously essential that the base of the line be as substantial as it can be made.

In cutting the first outline for a block, it is good practice to use a rather wide gouge held with the blade at about the angle indicated by the counters of the illustration at *a* in

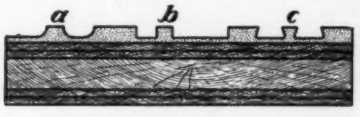


Fig. 13

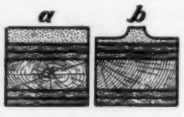


Fig. 14

Fig. 13. At a is shown the correct angle at which to carve. At b and c are shown the incorrect methods

Fig. 14. If both areas, a and b, are printed side by side, the small area b will have to withstand the same pressure exerted on the larger area a. The proper cutting angle, producing the strong counter shown at b, is therefore necessary

Figure 13, and to follow the lines on the block carefully, cutting to a depth of approximately ⅛ of an inch completely around the solids. For fine lines and fine details, use a small gouge and do not cut over 1/16 of an inch deep. After outlining the design, reverse the gouge and make a cut in the waste portion outside the design just deep enough and at the proper angle to release a triangular strip of linoleum about 1/16 of an inch wide on the surface. When the design is completely outlined the remaining portions of linoleum may be cut away with a large gouge or even with a chisel in case of a large cut. The veining tool may then be used to carve in fine detail in the body of the cut and to engrave any small lettering intaglio. Large intaglio lettering can be more accurately engraved by using a gouge held so that it slants toward the center of the letter to be carved. It is almost impossible to cut square corners or to draw out engraved cuts to a point with the veining tool, while with a sharp gouge this can be accomplished easily.

Another handy tool for block cutting besides the regular set of linoleum carving gouges and veining tools is the frisket knife. These knives are used by artists and photograph retouchers for cutting away the parts of a frisket which cover portions of prints to be shaded with the air brush. The blade is a piece of high-grade cutting steel about 3/16 of an inch wide and 1/32 of an inch thick and 2 or 3 inches long. This blade is mounted in a slit in a piece of dowel about the length of a pencil. As the blade is used up by sharpening, the wooden handle in which it is fastened is trimmed so as to be about ¼ of an inch back of cutting edge of the blade. This inexpensive form of frisket knife is sold by practically all dealers in artists' supplies.

Proofing the Cut

After the cut is engraved it may be proofed, preferably on a good proof press, although if this is not available a proof planer, a mallet, a brayer, and an ink slab will serve very well. The first proof should be compared with the original drawing and corrections made. It is not always necessary that the cut be exactly like the original drawing in every detail, since it is frequently possible to procure desirable effects in the linoleum which were not obtained in the original drawing. The beginner may find it necessary to retouch even after two or three proofs before a satisfactory cut is produced. This is especially true with respect to color blocks, which must be made to register accurately. In this case, however, it is good practice for the beginner to make the key cut or main outline first, using a proof of this cut as a guide by means of which the second and succeeding cuts may be made more accurately than would otherwise be probable.

Printing the Cut

If the linoleum used is already mounted on type-high blocks, it is only necessary to saw the block to the desired size before printing. If sawing is necessary, care should be exercised in squaring the block; otherwise great difficulty will be experienced in lock-up. Unmounted cuts should be tacked, or better glued, to wood blocks which are just thick enough to make the mounted cut type high (⅞ in.). It is better to have the block slightly less than type high rather than more, as deficiencies in height can be corrected by pasting sheets of paper on the back when it is being made ready for printing.

Once the cut is satisfactorily mounted and trimmed, it may be printed in several different ways, depending upon its purpose. Any form of printing press can be used. When used on a press it must be locked up in a chase and made ready in much the same manner as any other printing form. If it is to be printed in conjunction with metal type, the problem of make-ready is more complex than when the block is to be printed alone, since there is considerable resilience in the linoleum which must be compensated for in the make-ready, otherwise the pressure necessary to print the cut properly will either mash the metal type or cause it to cut through the paper. At best the type will be badly damaged if proper allowance is not made for the squeeze in the linoleum. Careful building up on the back of the cut with thin paper will produce better results than an overlay, but if the linoleum is of an unusually soft and pliable texture it may be necessary to use both an underlay and an overlay in order to get proper inking and to prevent damage to the inking rollers.

If accurate registering of cuts for color is not required, the ordinary form of letter press will serve very efficiently. In using the letter press the cut should be inked with a brayer and placed on the bed and a sheet of paper placed on the cut. If proof paper is used, the printing side should be placed next to the cut. If regular proof paper is not available, any soft grade of paper dampened slightly on the back will serve.

Selection of Paper for Printing

Linoleum blocks print better on antique-finished paper than on any other variety. This is especially true of prints in color.

Unless the make-ready is extremely accurate, glossy and enamel-surfaced stocks will not take ink from the full printing face of the cut. Slowing down the speed of press operation or increasing the interval of contact between the block and the paper helps some. However, the results are never as good as when a rough or antique-finished paper is used.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

An Incongruity

In a short while thousands of visitors will be flocking to Chicago to visit the Exposition inaugurated to commemorate a Century of Progress.

The very method adopted for opening this Exposition is emblematic of the scientific spirit of our age. The light from the planet Arcturus which has been traveling at a terrific velocity for many years through the trillions of miles of space which separate this planet from the earth, will be concentrated through a powerful telescope upon a photo-electric cell. This will cause the switches which control the electrical energy used for illuminating the Exposition, as well as for turning over the thousands of electrical power units, to close, and the Fair will be officially opened.

In a country in which science and industry has progressed so far as to make possible a Fair of the type of the Century of Progress Exposition, it would seem that ingenuity, science, and skill would be held in high repute. It would further seem that training which would ground the student in the principles of science, and which would give him an understanding and knowledge of the use of the tools, equipment, and materials of production, and a grasp of the principles of design, would be highly prized.

It seems incongruous, therefore, to read in the same publication that carries a laudatory article on the tremendous progress made by science and industry, of school directors who make the calm statement that because industrial arts and vocational education are but educational fads, they will be suspended for the sake of economy.

One can readily understand that school directors of this type might have objected strenuously to waste time and money on the teaching of the three R's to the slaves who pushed and pulled stones into position at the behest of overseers armed with sturdy whips as the pyramids of Gizeh slowly assumed shape. But that men on whose shoulders rests the determination of what to do and what not to do in present-day education can nonchalantly decide in this year of the Century of Progress that elementary- and junior-high-school students, many of whom will never receive any further education, do not need a good grounding in industrial-arts and vocational work to fit them for their future life is hard to understand.

There are such men, however, and while some of them will remain permanently blinded to the need of the training which industrial-arts work gives, yet there is hope that with continued effort some of them will be convinced of the value of the contention that industrial-arts work is not a fad, not a special subject, but an integral part of general education in our present civilization. This will come to pass only after it has been demonstrated that industrial arts and vocational education have social values, that they do fit the youth of today into the complex civilization of the present, and to this end the teachers and supervisors of these subjects must work without let-up.

The Value of Good Housekeeping

Recently a prominent industrial-arts supervisor, while visiting school shops, said to a fellow visitor: "Here is where the school shop can learn a great deal from industry." The sweeping gesture which accompanied these words took in successively piles of partly finished projects, stacks of rough castings, a number of assembled units, piles of material stacked in helter-skelter fashion, and a number of dark, discolored oil spots on the cement floor.

Many instructors pride themselves that their shops are conducted in the same way as industry conducts its shops; that the machines at which their students work are regular production machines; and that their boys when they leave school have little difficulty in adjusting themselves to their new surroundings. Yet, they completely forget to give this idea of cleanliness and shop housekeeping the emphasis that it ought to have. This, in spite of the fact that many of these men are good teachers who do an excellent job of teaching. They seemingly overlook cleanliness and orderliness as a part of school-shop training.

It is true, the problem of housekeeping in the school shop is somewhat different from that in the industrial shop. Probably it comes nearest to being comparable to conditions in the ordinary jobbing shop, which with its many varied jobs does not generally look as orderly and as clean as do the large-scale production shops. Nevertheless, the school ought not to be satisfied with mediocre standards. Modern production methods in their entirety may be out of place in the school shop, but the value of cleanliness which the big manufacturing firms have demonstrated to be not only possible but really profitable, may well be copied and accepted as standard in the school shop.

Of course, the realization and maintenance of a clean school shop means more planning for the shop teacher. It does not, however, mean much more work, although the amount of satisfaction gained when the clean shop has once been achieved, far outweighs any personal expenditure of time and thought and energy that the teacher may have given to the problem.

The student who has become habituated in the right practices of orderliness and cleanliness in the school shop can adjust himself very much more quickly to the routine of the industrial shop than the one whose education has neglected this item. Nor does it cost any more to include this extra bit of work in the school except that the instructor who is imbued with modern ideas of shop order and cleanliness will probably requisition more soap, rags, paint, and paint brushes, but the results which such an instructor will obtain with his students and with his classroom far overbalance the trifling extra expenditure of money and thought and planning.

Problems and Projects

FREE-HAND, THIRD-ANGLE PROJECTION FOR BEGINNERS IN MECHANICAL DRAWING

Jonathan Bright, Academy High School, Erie, Pennsylvania

(Continued from November, 1932, See Supplement No. 268)

Problem Sheet No. 14

Sectioning. This sheet contains two problems which may be used in the teaching of detail sections and six problems which may be used to teach half and quarter sections. A new line convention must be taught — section lines. Teach the standard sectioning for the common materials drawn in mechanical drawing.

CHIPLESS ICE PICK

A. L. Dell, Grand Rapids, Michigan

The chipless ice pick is a pleasing and unique variation to the usual list of small hand tools that the high-school boy may make for himself. While not difficult to make, it brings out and develops many principles of machine-shop practice.

Making the Handle

1. Cut stock 1/16 oversize in length and diameter.
2. Center.
3. Face ends.
4. Turn to diameter of knurl.
5. Chuck work in lathe.
6. Drill 5/8 hole from tailstock.
7. Turn bearing surface for lathe center by using feed on compound rest, set at correct angle.
8. Chamfer outside surface while work is still in chuck as indicated in drawing.
9. Knurl on lathe centers.
10. Re-chuck. Protect knurled surface.
11. Turn half ball shown in illustration.
12. Drill No. 14 hole from tailstock so hole breaks into 5/8 hole.
13. Locate tap hole.
14. Drill tap hole.
15. Tap.

Making the Pick Slide

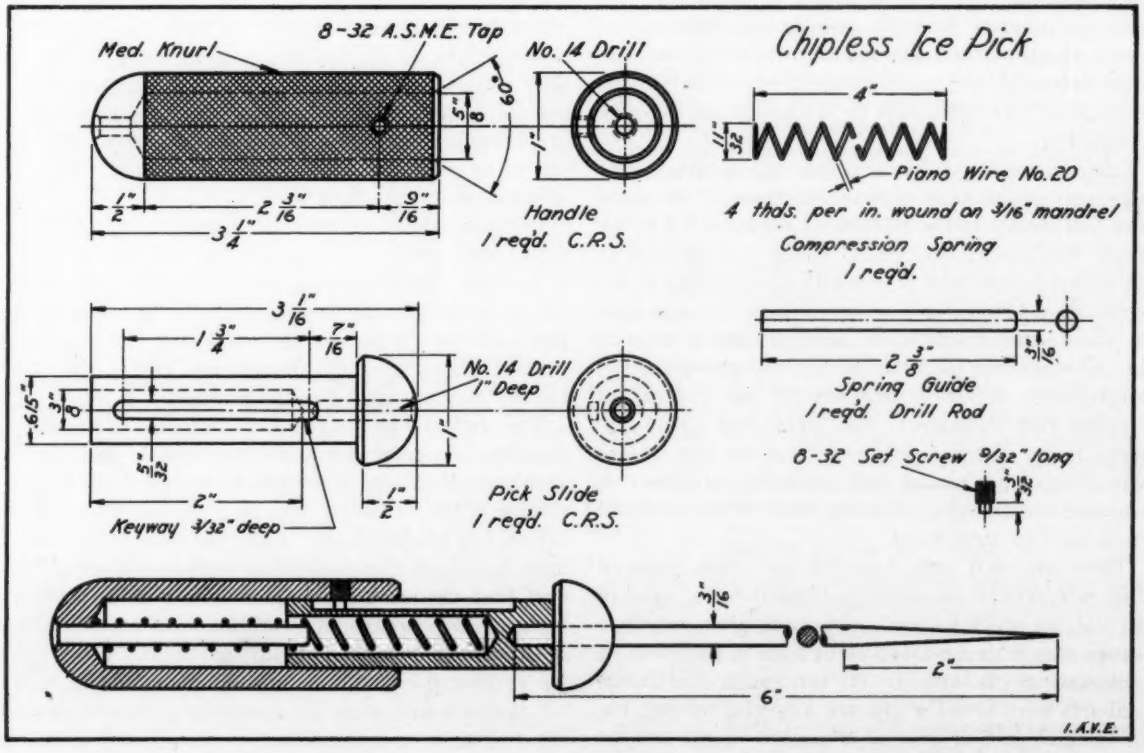
1. Cut stock 1/16 oversize in length and diameter.
2. Center.
3. Face ends.
4. Turn to diameter of half ball.
5. Turn .615 diameter to a square shoulder.
6. Chuck and drill 3/8 hole.
7. Re-chuck other end.
8. Drill No. 14 drill hole. Do not break it into the 3/8 hole.
9. Turn half ball.
10. Locate centers of drill holes at end of keyway.
11. Drill 3/32 deep.
12. Set up on a parallel in vise on milling machine.
13. Use slitting saw and mill keyway to length.

Making Compression Spring

1. If possible set feed gears of lathe so that automatic long feed will feed 1 in. for four revolutions of headstock spindle.
2. Set up wire in tool holder or spring winding tool in tool post and prepare mandrel for winding.
3. Secure instructor's approval and wind spring.

Making the Pick

1. Cut off stock to length required.
2. Grind, file, and polish point to shape.
3. Harden about 1 in. of point.
4. Temper by heating in the middle of the pick until a purple color appears at the point.



Making the Setscrew

1. Use 5/32 stock considerably over length.
2. Thread one end with 8—32 A.S.M.E. die far enough to make screw.
3. Slot end with hand hack saw.
4. Saw off to length.

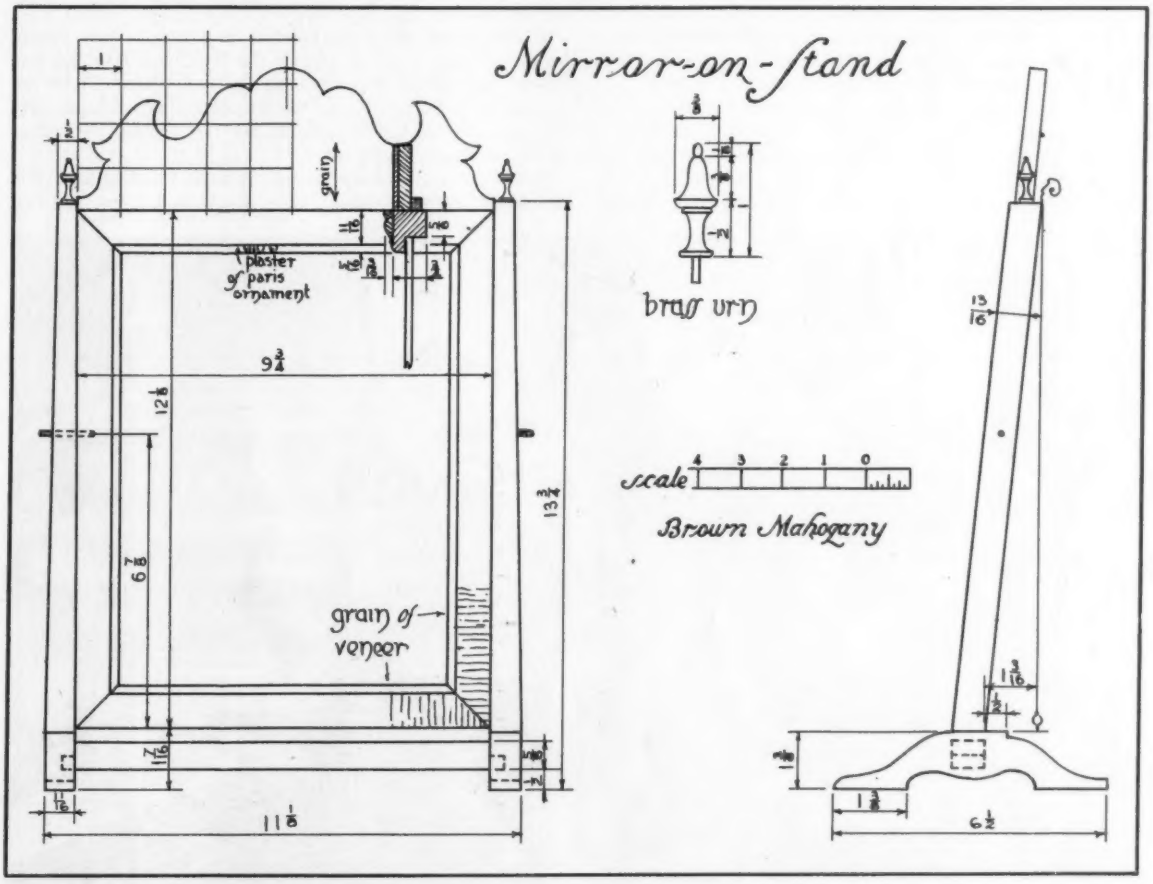
Assembly

1. Cut off 3/16 stock for spring guide correct length.
2. Remove burrs from unfinished ends of pick and spring guide.
3. File and polish all parts needing a fine finish at speed lathe or engine lathe.
4. Force pick into pick slide.
5. Force spring guide into handle.
6. Complete the assembly so that setscrew retains pick slide in handle.

MIRROR ON STAND

Burl N. Osburn, Millersville, Pennsylvania

This little toilet mirror, which is the property of the Essex Institute, Salem, Massachusetts, belongs to a simple type which came into use about the middle of the eighteenth century. At that time, these mirrors were used on top of low-boys, or low chests of drawers. It is the forerunner of the mirrors now attached to bureaus. These mirrors also were occasionally mounted on top of a series of small drawers, with elaborate, curved supports.



The one illustrated herewith consists of an ornamental frame with a crest of plywood, mounted on a plain supporting frame. The face of the frame is of veneer, laid with the grain running across the frame, and with a gilded, plaster-paris leaf-design molding along the edge. The two tapered uprights supporting the mirror are topped with small brass urns. The scroll top is made of thick veneer, glued to a back with the grain running the opposite direction.

SIMPLE WOOD FINISHING

J. M. Wooddell, Cleveland, Ohio

It may be observed in many school shops that frequently the wood finishing, which should add to the beauty of the project, is disappointing because it is poorly done.

This is probably due to the fact that most school shops do not have adequate facilities for wood finishing. The instructor, therefore, is confronted with the problem of selecting that type of finish which will give the best results under the conditions.

The finish which is described in this article has been found to give good results even under unfavorable conditions. It is easy to apply, requires but a short time, and makes a beautiful finish. It is here described as applied to American walnut but may be adapted to other woods as well.

Preliminary operations are: (*a*) Remove all tool marks and glue spots; (*b*) Fill all nail holes, imperfections in the wood, etc., with stick shellac or plastic wood (walnut color); (*c*) Sandpaper thoroughly. Avoid sanding across the grain.

Finishing: 1. Raise the grain by sponging with warm water. Allow to dry two or three hours. Sandpaper again with 2/0 sandpaper.

2. Apply walnut filler. If a very light walnut color is desired, use natural-color paste filler adding raw-umber oil color to make the filler the color of walnut or slightly darker. Natural filler will show white in the grain of the wood after drying if coloring matter is not added. Filler should be applied carefully as it builds the foundation for a successful finish.

3. Apply a coat of very thin shellac, white or orange (add 50 per cent alcohol to the shellac). Allow to dry from two to three hours and rub down with fine steel wool. Apply a second and a third coat of thin shellac and rub down in the same manner.

4. Apply a coat of furniture wax and polish thoroughly. Apply a second coat of wax a day or so later.

A good quality of this finish is that it is not affected seriously by the dust found in the ordinary shop. As shellac dries quickly, no great amount of time is spent waiting for coats of finish to dry. The finish obtained is soft and lustrous, and it may be renewed easily by waxing.

Some of the more common reasons for failure in wood finishing in school shops are:

1. Failure to prepare wood properly for the finish.
2. Failure to fill wood properly.
3. Use of dirty brushes and poor materials.
4. Piling coats of finish on too thick.
5. Failure to rub down sufficiently between coats.
6. Using sandpaper and steel wool that is too coarse in rubbing down before and between coats of finish.
7. Applying finish in a cold or damp room.
8. Applying finish before previous coat is thoroughly dry.

A DRAWING TABLE

Paul C. Nelson, The Stout Institute, Menomonie, Wisconsin

The drawing and study table illustrated and described in this article has won wide approval in the dormitories of the Stout Institute.

As will be noted from the illustrations, the combination feature has been accomplished with the greatest simplicity. To change the table from study to drawing table, the top is pulled forward. A straight backward push on the front edge of the top replaces it to its level position. There are no screws or levers to adjust, and the table is absolutely rigid in either position. The top, when tilted, will easily support the weight of a man anywhere on the top, as is shown in Figure 1.

The table is large enough to accommodate practically all drawings made by the students. The top may, of course, be made of any desired size, although the distance between the cleats should be over 28 in., so that all of the pieces will fit between the cleats when the table is disassembled for crating.

The table has been made 28¾ in. high so that an ordinary chair may be used while the table top is in either the flat or in the tilted position, as shown in Figures 3 and 4.

Figure 5 shows the table in the take-down position. This may be done by removing a few screws in the top shelf and brace, one screw from each of the steel links, and the two bolts in the lower stretcher. All of the parts may then be stacked between the cleats dovetailed into the top, so that the table makes a comparatively small and compact package, which may easily be tied together or crated for shipment.

The top should be made of clear white pine or of basswood. The balance may be made out of any suitable hard or soft wood.

Method of Construction

The stock is roughed out in the usual way, according to the dimensions given in Figure 2. Then the mortise-and-tenon joints are laid out and cut, and the holes are bored in legs and stretcher for the bolts and nuts.

Patterns should next be made for the various curves. After the individual pieces are marked off from the patterns, they should be sawed on a band saw. If the smoothing of these curved edges is to be done by hand, they should be sawed carefully and right to the outside of the pencil lines. They may then be smoothed by light cuts with spokeshave and file, and by sanding.

If the curved edges are finished on a shaper, they should be sawed about 1/16 in. outside the lines. Accurate and safe shaper jigs should be made, one for each shape. These are illustrated in Figures 6 and 6*a*. The pieces are clamped into the jigs and finished by guiding the jigs against the shaper collar, as shown in Figure 7.

Rabbets for shelf and stretcher, recesses for steel links, and bevels for tilt-top clearance then should be laid out and cut.

Fig. 1. The top, when tilted, is extremely rigid. Fig. 3. Convenient proportions for an individual study table. Fig. 4. Steady and convenient drafting position when sitting on an ordinary chair. Fig. 5. Ready to move. Even the table, when dissembled, will fit into a corner of the car. Figs. 6 and 6a. Shaper jigs must be made to hold the stock very securely. If a single-spindle shaper is used, the jigs must be designed so that the cutting is done "with the grain." Fig. 7. The shaper is a very dangerous machine. Its knives must be well fitted and fastened, and the best possible guards should be used. This guard was moved back while making the picture. Fig. 8. The cleats should be fitted so that they can be pushed in to within 6 in. of final position. This will seat them firmly when driven "home." Fig. 9. A tapered jig is used for cutting one side of the dovetail dado.

The shelf and brace should be cut to correct length and holes drilled and countersunk for screws.

The individual pieces must be smoothed on sides and edges, after which the legs, feet, and rails may be glued together. The entire frame may then be assembled with screws and bolts.

Constructing the Top

The top should be glued up of narrow strips, preferably not over 3 in. wide, to reduce warping. It must be planed smooth after gluing and be cut accurately to width and length.

The dovetail dado cuts, ¼ in. deep, are beveled 3/32 in. on each side. They are laid out so as to make the finished dado taper 1/16 in. across the width of the top. This tapering of the dovetail dado is very important, as it is extremely difficult to fit the cleats tightly all the way across the top if the dado is of uniform width (Fig. 8).

The side cuts for the dadoes may be made on a circular saw with tilting table or tilting saw. One side cut for the dado is made by guiding the end of the top directly against the saw gauge. When making the second cut, it is necessary to use a tapered jig against the end of the top (Fig. 9), which will give a taper of approximately 1/16 in.

The surplus material in the dado is removed with a chisel, and the cut finished with a router plane. The cleats are fitted to the dovetail dadoes with a Stanley 45 or 55 plane, in which a blade is used having the correct bevel. The cleats should be

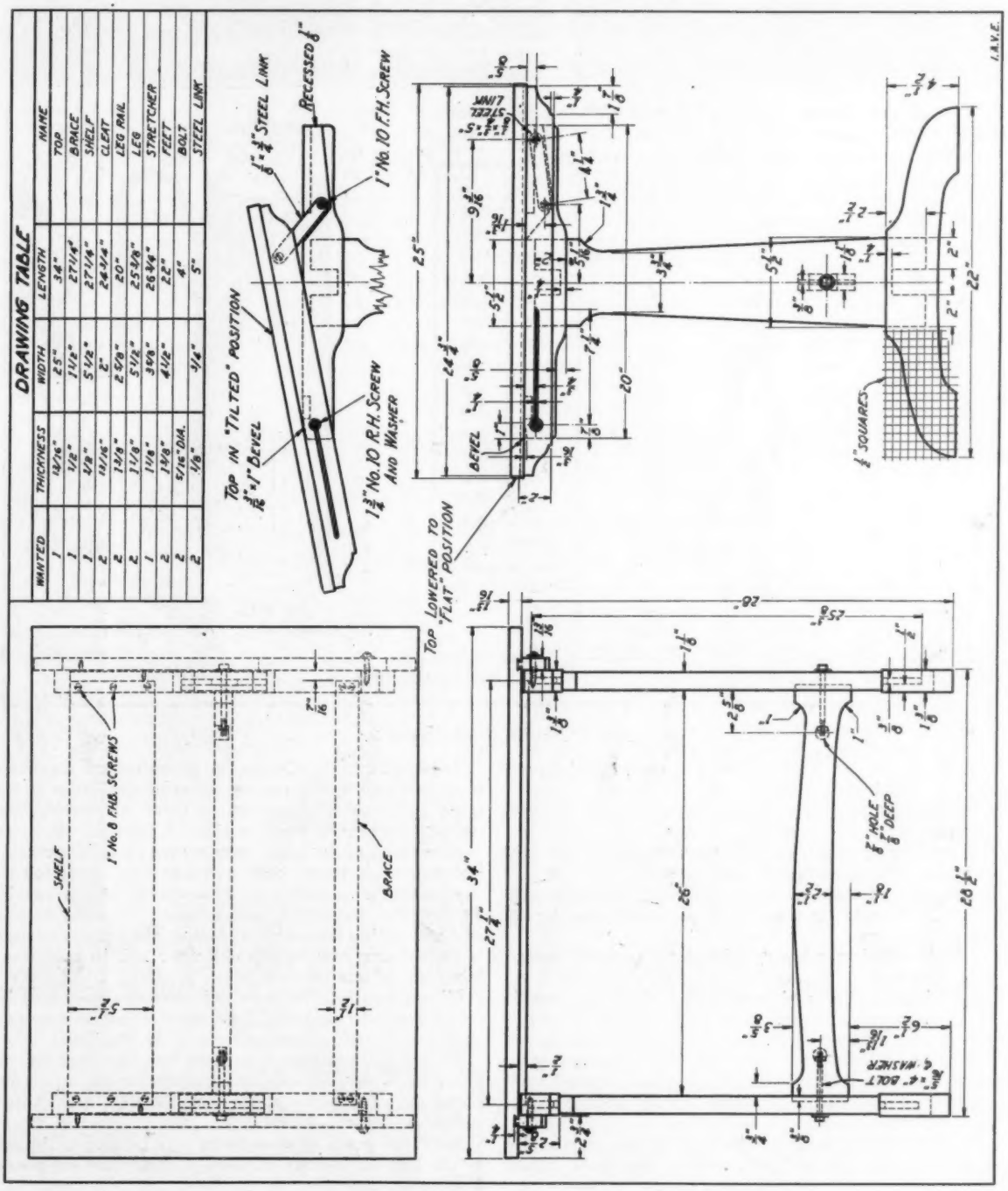

DRAWING TABLE
WANTED | THICKNESS | WIDTH | LENGTH | NAME
1 | 13/16" | 25" | 34" | TOP
1 | 1/2" | 1 1/2" | 27 1/4" | BRACE
1 | 1/2" | 5 1/2" | 27 1/4" | SHELF
2 | 13/16" | 2" | 24 1/4" | CLEAT
2 | 13/16" | 2 5/8" | 20" | LEG RAIL
2 | 1 1/8" | 5 1/2" | 25 3/8" | LEG
1 | 1 1/8" | 3 1/2" | 26 3/4" | STRETCHER
2 | 1 1/8" | 4 1/2" | 22" | FEET
2 | 5/16" DIA. | | 4" | BOLT
2 | 1/8" | 3/4" | 5" | STEEL LINK
Top in "Tilted" Position
1" No. 10 F.H. Screw
Recessed 1/8"
1 3/4" No. 10 R.H. Screw And Washer
Top Lowered to "Flat" Position
Steel Link
Bevel
1" Squares
1" No. 8 Fhd. Screws
Shelf
Brace
3/8" Hole 1/2" Deep
1/4" Bolt & Washer
I.A.V.E.

Fig. 2. Details of drawing table

made about ⅛ in. shorter than the width of the top. This is to prevent them from projecting later if the top should happen to shrink in width.

Final Assembling

The links are easily made with drill, countersink, and file. Their pivot positions are carefully marked on the cleats and on the top rails, and the final assembling can then be done. The arrises may have been softened on each individual piece during the smoothing operations. If not, they should be carefully softened after final assembling. This makes the arrises less exposed to injury, and it gives the table a richer, more finished appearance.

Finishing

A clear, transparent finish seems appropriate for this table, especially if it is made of a good quality of light-colored wood. This finish may be applied to all the pieces, except the top, in the following manner:

1. Brush into the surfaces a coat of pure, boiled linseed oil. Let dry 24 to 48 hours.
2. Apply a thin coat of white shellac, 2-lb. cut. Let dry 24 hours.
3. Sand lightly with 3/0 garnet paper, and apply a thin coat of high-grade rubbing varnish. Let dry 24 hours.
4. Sand as smooth as possible without cutting through varnish, and apply the second coat of varnish. Let dry 48 hours.
5. Sand as before and apply third coat of varnish. Let dry only 24 hours.
6. Without sanding, apply a full flow coat of same varnish as used for previous coats. Let dry at least 72 hours.
7. Sand carefully with 4/0 or 5/0 garnet paper to cut varnish to a fairly even surface. Rub with FF pumice stone and water using a felt rubbing pad. Rub carefully and wash the surfaces frequently to watch the rubbing progress and to avoid cutting through.
8. Wash clean with clear cold water, wipe the surfaces dry with clean soft rags, and polish with a very small amount of lemon oil or other good furniture polish.

To produce a good, but less expensive finish, two coats of good interior varnish may be applied after the shellac coat, and the final finish made by applying a coat of dull varnish.

The top may be finished by applying three coats of white shellac, 2-lb. cut. Each coat should be sanded, and in addition, the final coat should be rubbed with steel wool, or with FF pumice stone and rubbing oil.

A SPIROMETER

R. H. Jenkins, Humbolt State Teachers' College, Arcata, California

The spirometer described herewith is a device which measures lung capacity. The growing boy who is athletically inclined is naturally interested in his chest development. When a boy proves to himself that his lung capacity is below that of his friends, he begins to take a decided interest in developing himself. Hence the spirometer is of great value in the home or in the boy's club.

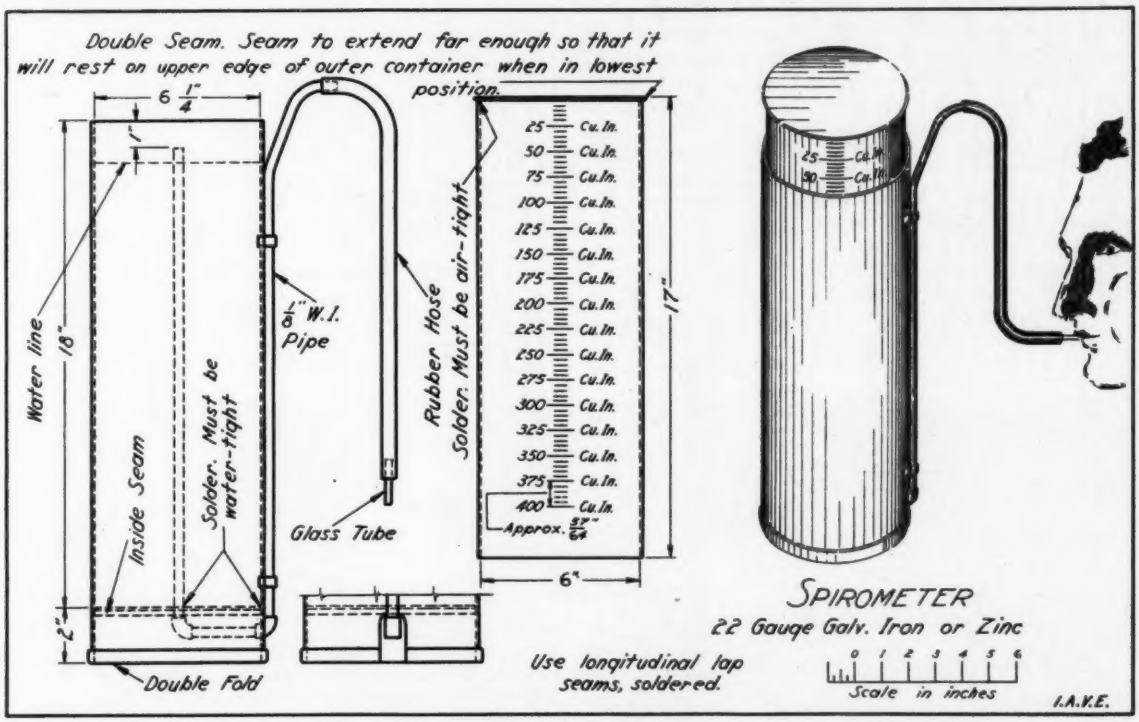


Fig. 1. Details of the Spirometer

To build a spirometer, make two galvanized-iron containers of such dimensions that the one will easily slide inside of the other. These may be either square or round. A convenient size for the containers is shown in Figure 1. Through the center of the bottom of the larger container runs a ⅛-in. wrought-iron pipe which should come within an inch of the top on the inside, and an inch or so above the top on the outside. To the outer end of this pipe a section of rubber hose is attached for the convenience of blowing. The outside container is filled to very near the top with water and the inside container slipped into place.

All seams on both the inner and outer containers must be soldered air- and watertight. The inner container must next be graduated in cubic inches, as shown in the illustration.

To operate the machine blow slowly into the rubber hose all of the air in the lungs that can be expelled in one breath. By noting the cubic inches as the container rises, a quick and definite reading may be obtained.

Individual pieces of glass tubing may be used in the end of the hose for sanitary purposes, if more than one person is using the spirometer.

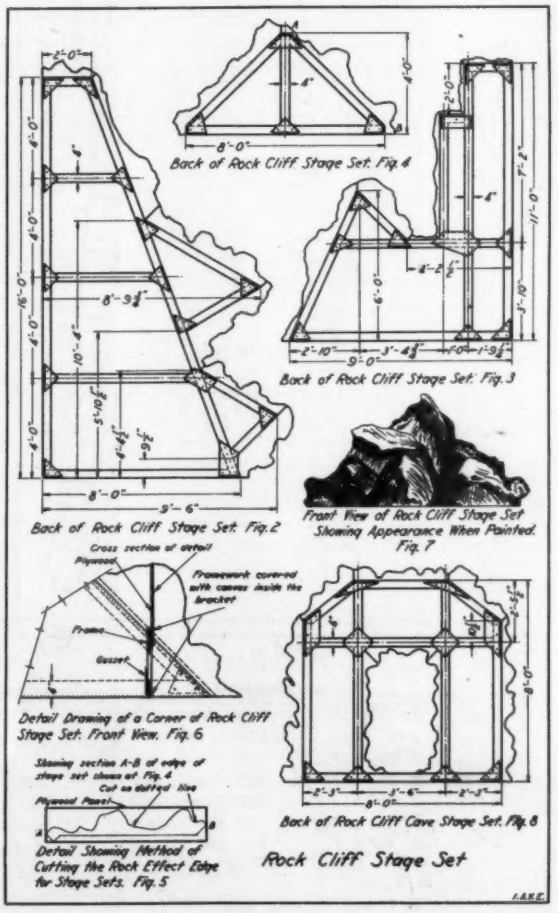
Fig. 1. Rock-cliff stage set built in the school shop

STAGE SCENERY AS A SHOP PROJECT

Hyrum Jenkins, South High School, Salt Lake City, Utah

Every high school at some time during the year puts on a play or an opera which needs stage scenery of some kind or other. This scenery may be very expensive unless the school shop can make all or most of it.

To solve this problem of cutting down costs, Miss Dyer, vice-principal of South High School, devised the following method. About six or eight boys were chosen as a stage crew and they were given stagecraft during the last period of the day. They received regular credit for this work and are paid for their time if they work at night performances. Whenever a new set is needed, the instructor who puts on the play, the school principal, and the shop instructor decide what pieces have to be built. They also determine upon size, color scheme, etc. Then the shop instructor, with the aid of the stage crew, designs and builds the pieces.


Back of Rock Cliff Stage Set. Fig. 4
Back of Rock Cliff Stage Set. Fig. 3
Back of Rock Cliff Stage Set. Fig. 2
Front View of Rock Cliff Stage Set Showing Appearance When Painted. Fig. 7
Detail Drawing of a Corner of Rock Cliff Stage Set. Front View. Fig. 6
Back of Rock Cliff Cave Stage Set. Fig. 8
Detail Showing Method of Cutting the Rock Effect Edge for Stage Sets. Fig. 5
Rock Cliff Stage Set

Details of stage set

Figure 1 shows the scenery built in this way for the opera called "Pirates of Penzance." A large drop curtain was painted to represent the ocean. The pirate ship was a special piece, as it had to be taken off stage during the second act. The cliffs and the cave were made as individual pieces of scenery.

The cliffs were painted to represent red sandstone, the trees showing through at various places. Water paints were used because of their cheapness and because of the ease with which they can be applied. Deep contrasting colors were chosen in order to show rugged appearance.

Method of Procedure

1. Decide on size and shape of each piece needed.
2. With a piece of chalk lay out on the floor full-sized details of the piece to be made.
3. Cut the framework to fit the plan on the floor.
4. Nail the frame together with corrugated fasteners.
5. Cover all joints with plywood gussets.
6. Cut out the edge profiles on plywood strips with a band saw.
7. Cut the canvas to fit the frame and tack it on with carpet tacks. If the canvas is not wide enough to cover a given space, sew two or more pieces together.
8. Give the canvas a coat of glue size, and allow it to dry for several hours.
9. Paint on the scenery.

Some sets may be so large that it becomes necessary to make them in sections that can be folded together so that they may go through shop and stage doors. The plywood used for the edges is cut into 6-in. or 8-in. strips. The strips do not need to be any wider because all that is required is an irregular edge.

Materials

One by three-inch common pine may be used for framework, with ¼-in. 3-ply fir for edges and gussets.

Five-eighths-inch corrugated fasteners are used at the joints. It is well to buy canvas that is of a good grade.

Other materials used are carpet tacks, glue size, water paints, and ⅞-in. No. 7 screws.

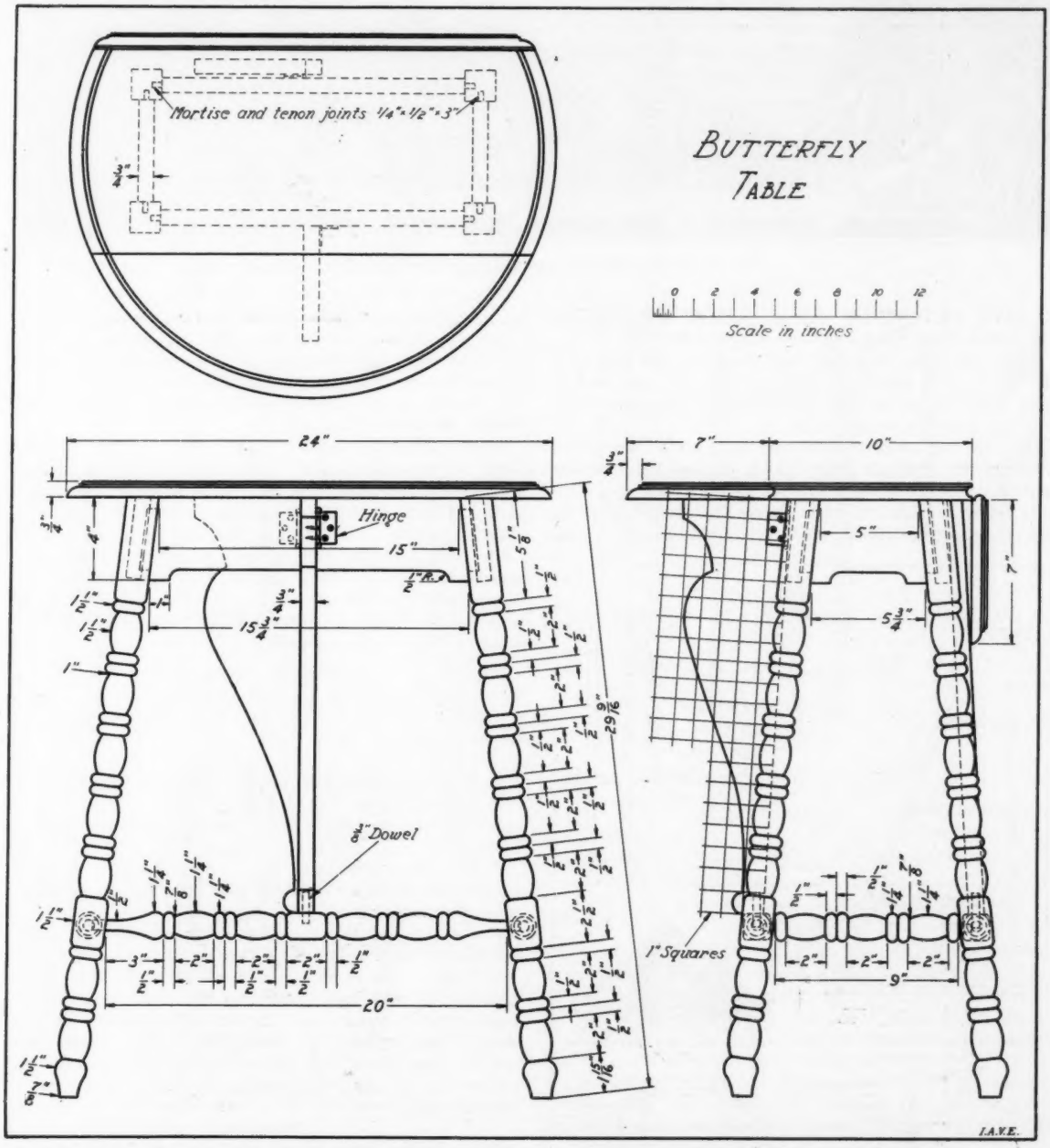
Figure 2 shows one of the large cliffs made for the opera mentioned. All of the details of construction are shown. Figures 3 and 4 show other cliffs. Figure 5 shows the method of how the edges are cut, Figure 6 shows a detail of a corner, Figure 7 the front of a rock cliff after it has been painted, and Figure 8 the detail of a cave.

The pirate ship was 8 feet wide and 12 feet high.

BUTTERFLY TABLE

J. J. Sasser, High School, Sour Lake, Texas

This type of butterfly table dates back to the sixteenth century, and is a very famous piece of colonial furniture, which could be found in almost every bedroom of our forefathers, and is one of the easiest pieces of colonial furniture to construct.



Usually this table is made of walnut, but other hard woods, such as birch, gum, maple, and pecan, also may be used.

The turned legs are of the spool type, which is one of the favorite designs of the colonial days. They are very easily turned on the lathe and furnish a good turning problem.

The wings, each of which swings on a hinge and a dowel, support the drop leaves. They may be made of any design desired.

In finishing the table a coat of water mixed with glue is applied to keep the grain from raising when the walnut water stain is applied. After this size is dry, rub the table down with No. 3/0 sandpaper, and then apply the stain. Allow the stain to dry and then put on a walnut filler, rubbing it well across the grain. Let dry, then sand with a No. 3/0 sandpaper.

Put two coats of shellac on the project and rub between the coats with pumice stone and oil.

Apply two coats of clear varnish and rub each coat down with pumice stone and oil to get the desired smooth finish.

Bill of Materials

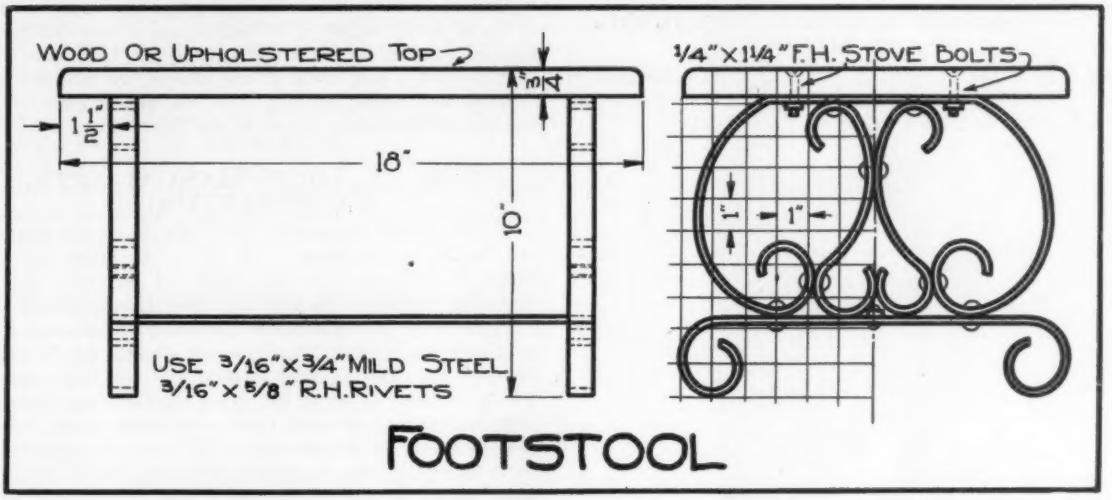
2 pc.	¾ x 8 x 25	Drop sides of table top
1 pc.	¾ x 11 x 25	Middle of top
4 pc.	1½ x 1½ x 31	Legs
2 pc.	1¼ x 1¼ x 22	Bottom side rails
2 pc.	1¼ x 1¼ x 12	Bottom end rails
2 pc.	¾ x 4 x 18	Top side rails
2 pc.	¾ x 4 x 7	Top end rails
2 pc.	¾ x 6 x 21	Wings
1 pr.	Butt hinges	
1 pc.	⅜ in. Dowel rod 4 in. long	

METAL FOOTSTOOL

H. O. Jaeger, Moline, Illinois

All metal used for the footstool described herewith is 3/16 by ¾-in. mild steel.

Make a layout of each piece on a board, then take a piece of string and place it along the outline of the layout, thus finding the length of each strip.



Place a piece of pipe or rod of the diameter of the small curve in the vise. Then heat the ends of the metal and form them over the pipe.

Bend all large curves over horn of anvil. It is not necessary to heat the metal for the large curves. Be sure to compare all pieces with the layout on a board so as to obtain the correct shape.

After all of the pieces have been bent find the location of rivet and bolt holes which may be obtained from the layouts. Drill or punch 13/64-in. holes for the rivets and 17/64-in. holes for the bolts.

Assemble all metal parts, fastening the feet and brace together before connecting the upright pieces. Use 3/16 by 5/8-in. r.h. rivets for this work. The top should be made out of a good grade of wood if it is to be finished natural. If the footstool is to be upholstered, however, a cheaper grade of lumber may be used.

Bore the required holes in the top 17/64 in. and countersink to allow the head of bolt to fit flush with top of wood. Fasten the legs to the top with ¼ by 1¼ f.h. stove bolts, placing a ¼-in. lock washer beneath each nut, thus making a very firm joint.

If the top is to be left natural, the legs and top may be fastened together from underneath with r.h. blued screws so as to have the top unmarred.

Apply three coats of lacquer to the metal parts. Then finish the top as desired.

Personal News

DEATH OF OLIVER W. TROUTMAN

Oliver W. Troutman, for the past twenty years head of the manual-training department of the Central State Teachers' College, Mt. Pleasant, Mich., died on March 30 at Seneca Falls, N. Y., following an attack of pneumonia.

Mr. Troutman, a native of Seneca Falls, began life as a patternmaker, but after some years spent at that trade, he became an instructor in the subject at Cornell University, Ithaca. From Cornell, he went to Central State Teachers' College, where for twenty years he had been head of the manual-arts department. During the twenty years of his service, hundreds of boys and young men came under Mr. Troutman's instruction and learned from him skillful workmanship and high ideals of handicraft. The outstanding characteristic of Mr. Troutman's teaching was his fine conception of its purpose.

Mr. Troutman is survived by his widow and four nephews to whom he acted as foster father.

MR. McGEE GOES TO LEWISBURG, PENNSYLVANIA

Mr. Richard A. McGee, formerly supervisor of education in the U. S. Penitentiary Annex at Fort Leavenworth, Kansas, has recently become supervisor of education at the U. S. Northeastern Penitentiary at Lewisburg, Pa.

RICHARD A. McGEE
Supervisor of Education, U. S. Northeastern Penitentiary, Lewisburg, Pennsylvania

Mr. McGee is a native of Minnesota. He graduated from Teachers College, St. Cloud, in 1916, and from The Stout Institute, of Menomonie, Wis., in 1919. He obtained his B.S. degree from the University of Minnesota in 1923 and his M.A. from the same institution in 1928.

After a period of teaching and administrative work in Minnesota schools, he became head of the industrial-education department at the State Teachers College, Minot, N. Dak., in 1923, was instructor at The Stout Institute in 1924,

and became head of the industrial-arts department at the University of Minnesota in 1926. From 1931 to 1932 he was supervisor of education at the U. S. Penitentiary Annex of Fort Leavenworth. He also was lecturer in industrial-education work during the 1929 summer session at the University of Washington.

Mr. McGee is the co-author of several well-known industrial-arts texts.

MR. BRANDT ELECTED AS SCHOOL-BOARD MEMBER

Mr. J. A. Brandt, head of the sheet-metal department at Mooseheart, Ill., was elected member of the East Side school board at Aurora after a heated election recently.

MR. J. A. BRANDT
High School, Mooseheart, Illinois

Mr. Brandt has had considerable industrial experience, having served apprenticeships in both cabinetmaking and in sheet-metal work. He obtained his training at the State Normal College, Kirksville, Mo., after which he taught at the St. Charles Military Academy, Missouri Military Academy, David Ranken School of Mechanical Trades, Army Educational Corps, A.E.F., and at Mooseheart.

Mr. Brandt is well known as a writer on apprenticeship and on vocational subjects. He also is active in labor organizations where his knowledge of education is highly prized.

¶ Mr. Sigurd F. Bloomquist, teacher of manual training in the high school, Bloomington, Ill., died at a hospital on January 18, following an operation. Mr. Bloomquist, who was born in Bloomington, was graduated from the Bloomington High School and completed his education at the Illinois Normal University and Bradley Polytechnic Institute. He had been connected with the manual-arts department of the high school since 1923.

Associations, Conventions

APRIL MEETING OF THE BOSTON VOCATIONAL SOCIETY

The regular monthly meeting of the Vocational Education Society of Boston was held Saturday, April 8, at the Hotel Westminster, Boston, Mass.

The main speaker was Mr. F. H. Pierce, principal of the Beverly High School and coördinator of the Beverly Trade School. Speaking on the subject, "Manual Education, the 1940 Model," Mr. Pierce said: "One of the reasons why the educational cause is suffering so badly from the effects of retrenchment is that we lack an effective, aggressive leadership." To meet the needs of an ever-changing civilization, it is necessary to have a more flexible, mobile, and adaptable organization. Mr. Pierce urged a change of emphasis in educational thought, pointing to the fact that investigations have shown that failures in the industrial and business worlds are largely due to a low rating in personal traits rather than to a lack of technical skill. The function of the school as a social agency, he said, is to develop in each boy and girl an understanding of the economic factors of civilization and a more intelligent sense of appreciation of the real value of life. There must also be developed a deep sense of the necessity of integrity and dependability among all men. The talk was followed by an interesting discussion. — *Louis A. Van Ham.*

THE ST. LOUIS MANUAL-ARTS CLUB MEETING

The St. Louis Manual-Arts Club held its annual banquet and meeting at the Mark Twain Hotel, on Friday evening, March 3. Teachers of the local high and vocational schools, as well as teachers of the outlying districts, were present.

Prof. R. W. Selvidge, of the University of Missouri, gave a talk on the subject, "Realizing our Objectives," in which he emphasized that in order to make the objectives work, it will be necessary to set up the proper experiences and associations and then to measure these experiences to see if they are accomplishing the objectives. He cited the purposes of teaching and mentioned twelve objectives which had been found practical.

Following the talk, a round-table discussion was held. — *Clarence E. Mawdsley.*

INDUSTRIAL EDUCATION CLUB MEETS IN PEORIA, ILLINOIS

The Industrial Education Club of Peoria, Ill., held its meeting on Monday, April 10. Dr. A. F. Siepert, of Bradley Institute, acted as chairman of the meeting. Thirty members attended.

The group made a tour through the plant of the Caterpillar Tractor Company under the guidance of Mr. Ben Moffatt, superintendent of plant training and member of the Industrial Education Club.

Mr. M. J. Gregory, foundry manager of the Caterpillar Company, addressed the visitors on "Advancement in Foundry Practices and Methods." He showed how working conditions had been improved, safety measures inaugurated, and what methods were taken to control dust and gas. He pointed out that present-day foundries were quite different from what they were ten to twenty years ago.

Following Mr. Gregory's address, Dr. W. T. Bawden, of The Manual Arts Press, led a general discussion on "The Qualifications for Industrial-Arts Teachers of Illinois." — *F. L. Barloga.*

PITTSBURGH INDUSTRIAL-ARTS ASSOCIATION MEETS

The annual spring meeting of the Trade and Industrial-Arts Association of Pittsburgh and the vicinity was held April 7 and 8, at the Carnegie Institute of Technology. Dr. G. D. Whitney, of the University of Pittsburgh, presided at the meeting on Friday.

Mr. Howard L. Briggs, of Cleveland, Ohio, speaking on the subject, "Meeting the Problems of Trade Training in a Community," said that the first essential difficulty to be overcome in any vocational program is to overcome prejudice and fear, and to sell the program to the community so that popular support will be given to it.

"New Problems in Education Due to Labor-Saving Machinery," was the topic of Mr. J. E. Wagner, director of industrial education of Johnstown. He said that specialization

and accelerated production in industry have changed industrial processes, and that short-term training for special jobs, elimination of processes, and education for leisure time will have to be embodied in the educational program of the future.

Mr. L. H. Dennis, deputy superintendent of public instruction, Harrisburg, gave a summary of the discussions and emphasized the program of education for leisure occupation. He emphasized that the future worker must be able to work at more than one job. This means that the range of vocational opportunity in the school must be broadened, and that there must be more occupational research so that the program of vocational education may function better in the community.

The Saturday session was in charge of Mr. E. A. McGill, president of the association. A talk on "Our Changing Occupations" was given by Mr. John D. Beatty.

Dr. Ben G. Graham, superintendent of the Pittsburgh schools, talked on "Modern Trends in Education." A conference on vocational guidance followed the general meeting. — *George C. Donson.*

CENTRAL CONNECTICUT INDUSTRIAL-ARTS TEACHERS MEET

The third meeting of the Industrial-Arts Teachers of Connecticut was held at the Sedgwick Junior High School, West Hartford, with 60 teachers in attendance.

Mr. Albert I. Prince, of the State Board of Education, spoke on the present economic situation where conditions have called for the cutting of all budgets in city departments. In order to insure a good balanced program, he argued that contacts with the academic teacher should be frequent and coördination of work high. He also mentioned the need of giving the work of the industrial-arts teacher more and continuous publicity.

Mr. Carl A. Riechie, superintendent of schools of Bristol, spoke on the history of education in this country. America, he said, has developed an individualism which no other country possesses. No attempt is made to have all pupils alike, nor to make all do the same thing at the same time. In the future, educators must, first, train for the proper use of leisure, second, give greater attention to the individual's special talents or exceptional abilities, and third, implant a deeper consciousness of what the American government stands for. In other words, our pupils must be taught more and more how to live properly. — *Harry A. Barnicle.*

PORTO RICO MANUAL-ARTS TEACHERS MEET AT SAN JUAN

The manual-arts and industrial-education teachers of Porto Rico held a meeting at the Baldoriorty de Castro Technical School, at San Juan, for the purpose of organizing a "Manual Arts Association."

At the meeting, the association adopted a constitution, and decided to affiliate with the American Vocational Association.

The following officers were elected for the ensuing year: President, Victor Rosario; honorary president, Francisco C. Urgell; vice-president, Humberto Padro; secretary, Juan López López; treasurer, Ferdinand Rossy; auditor, Raul Torres; directors, Francisco Montes, Diego Hernandez, Antonio Figueroa, and Andrés Salazar. — *Jose Vizcarrondo.*

PI ALPHA TAU FRATERNITY BANQUET

The Pi Alpha Tau Fraternity held its fifth annual interchapter banquet in Newark, N. J., on March 25, with 50 members in attendance. The fraternity is an organization comprising the graduates of the Newark State Normal School Manual Training Course. Among the speakers at the banquet were Dr. A. L. Johnson, Dr. M. Ernest Townsend, and Mr. Chester A. Zeliph.

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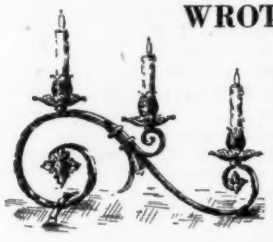

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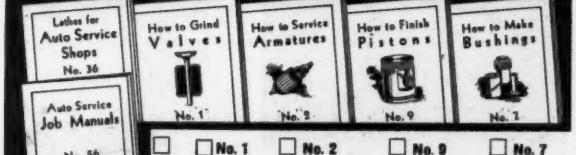
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New Publications

Syllabus of Design and Color

By A. Marie Anderson. Cloth, 108 pages, 6¼ by 9. Price, $1.25. Published by The Bruce Publishing Company, Milwaukee, Wis.

This book presents in outline form the principles of design and color and their application to practical problems. References are given throughout the book to definite pages in a number of standard textbooks.

The outline provided by this book will assist the teacher who is giving the course as well as the student in unifying, clarifying, and coördinating the information obtained from the various sources referred to.

Metal Plate Lithography

By C. A. Seward. Cloth, 69 pages, 9 by 12, illustrated. Published by The Pencil Points Press, Inc., New York City.

The author succeeds in giving a very clear and concise explanation of the processes. He shows clearly how each step is carried through. The book also contains a number of typical examples of the work.

Metal-Work

By Harry A. Jones. Paper, 112 pages, 5¾ by 8¾, illustrated. Price, 80 cents. Published by The Bruce Publishing Company, Milwaukee, Wis.

This is a very comprehensive little junior-high-school manual on elementary metal-work.

It contains the essential facts on the sources, methods of working, and common uses of lead, iron, copper, and steel.

Numerous line drawings add clarity to the printed text.

A Pupil's Workbook in Occupations

By James B. Edmonson and Arthur Dondineau. Paper, 116 pages. Price, 60 cents. Published by The Macmillan Company, New York City.

The mechanical-drawing text is so arranged that the assignments will fit students on three ability levels. This makes it flexible enough to keep all students fully occupied without exacting too much from any of them.

The occupational workbook leads the student step by step through the maze of diverse ways by which men earn their livelihood.

Mechanical Tightening

By L. E. Noble and J. A. Roenigk. Paper, 63 pages, 8 by 11, illustrated. Price, $1.

Mechanical Replacements

By J. A. Roenigk. Paper, 104 pages, 8 by 11, illustrated. Price, $1.25.

Electrical Maintenance

By J. A. Roenigk. Paper, 107 pages, 8 by 11, illustrated. Price, $1.25.

These books are published by McGraw-Hill Book Company, New York City.

The three instructional manuals contain related material, shop practice, and social-science instruction for the student of auto mechanics. Each manual takes care of one unit of the course. A study guide, list of references, and a number of questions to be answered by the student are part of each chapter.

Abstracts of Studies in Education at the Pennsylvania State College. By Drs. C. C. Peters and F. Theodore Struck. This little booklet contains 38 helpful and convenient abstracts, all bound in a single volume. The pages have been given the code number of the Loyola filing system, and they

(Continued on Page 7a)

(Continued from Page 6a)

may be cut down to such a size so that they may be used for filing purposes.

Vocational Education for Industry, Commerce and the Individual. This 49-page paper-covered pamphlet with a foreword by Charles W. Sylvester, director division of vocational education, Baltimore, Md., describes the plan and progress of the Baltimore school system. The work is in mimeographed form.

Industrial Try-Out and Finding Courses. This 158-page covered, 6⅞ by 8½ booklet gives a complete description of the work offered in the Fordson public schools at Dearborn, Mich. The work under the several headings is very helpfully outlined. Mr. A. C. Tagg, director of industrial education at Dearborn, is the author of the book.

Issue Booklet on Papermaking. The Kalamazoo Vegetable Parchment Company, Kalamazoo, Mich., has just issued a 20-page booklet entitled *The Story of Papermaking*.

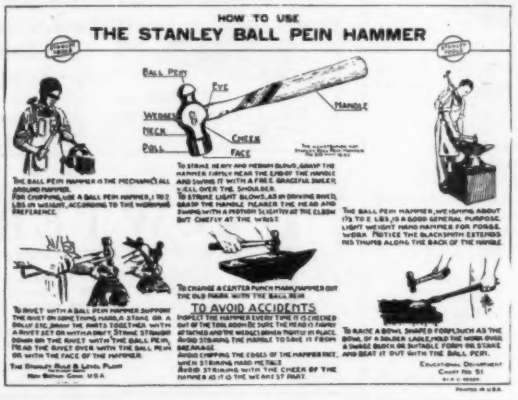
This little booklet contains the history of papermaking from its earliest days to the present day.

School-shop instructors will be interested in this material for work in connection with their shop classes.

SchoolShopEquipmentNews

STANLEY VISUAL TEACHING AIDS

The educational department of the Stanley Rule and Level Co., New Britain, Conn., has added eight new charts to the list of teaching aids which they have been furnishing to the schools in the past.



Six of the new charts are of interest to the teachers of metal working, auto mechanics, electricity, sheet metal, and general shops, and two are designed for the woodworking shops.

The charts to be displayed in the school shop are 14 by 18 in. and are printed on heavy white paper. Notebook-sized tracings for making blue prints for students' use also are obtainable.

For the schools not equipped for making blue prints, notebook-sized charts printed on white paper have been prepared. A merely nominal charge to cover the cost of printing has been placed on these printed notebook sheets.

LE PAGE'S WORKSHOP BOOK

The Russia Cement Company, of Gloucester, Mass., has just issued the third edition of Le Page's Home Workshop Book, containing twenty attractive pieces of furniture which may be made in the home or school workshop.

The booklet contains working drawings and directions for making each of the projects. The material is arranged in three groups. The first group contains a collection of old colonial

(Continued on Page 9a)

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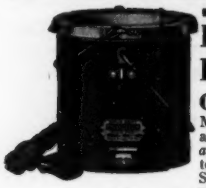

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ISSUE NEW BOOK ON CABINET WOODS

Albert Constantine & Son, Inc., 780 East 138th St., New York City, have announced a new book entitled, *Facts on Fancy Cabinet Woods,* which is an illustrated reference on nearly one hundred kinds of fine woods. This book shows actual examples of mahogany veneer, inlaid border, and carved moldings, gives the available source of supply in small or large quantities, suggests their possible use in the form of veneer, marquetry work, lumber, and plywood, and offers special instructions for the laying of veneers and other useful information. The book may be had at a nominal price to cover cost of printing.

DIXON CATALOG OF TOOLS AND SUPPLIES

William Dixon, Inc., 32 East Kinney St., Newark, N. J., has just issued a new and very comprehensive catalog, arranged in an interesting and attractive manner. The booklet is not just a catalog, but is in reality an encyclopedia or reference book of tools and materials used by the craftsman in art metal craft.

The catalog lists silversmithing tools, blow pipes, Bunsen burners, gasoline torches, soldering coppers, soldering supplies, casting outfits, drills, pliers, tweezers, wrenches, files, machine saws, scroll saws, and jewelry-making supplies. Tools for chasing, leathercraft, wood carving, sheet metal, linoleum printing, and metal spinning also are illustrated and listed.

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TRACING SUPPLEMENT, No. 267, JUNE, 1933

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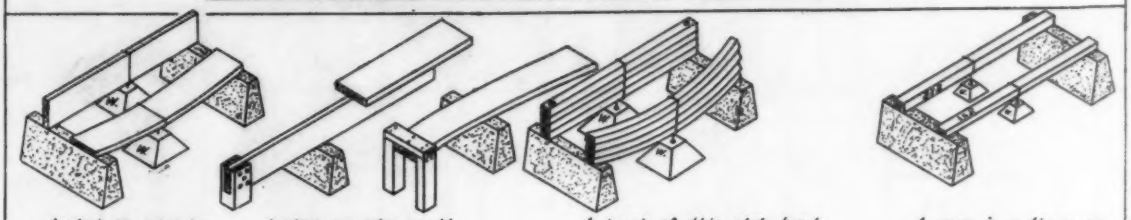
"A STIFF PROPOSITION"

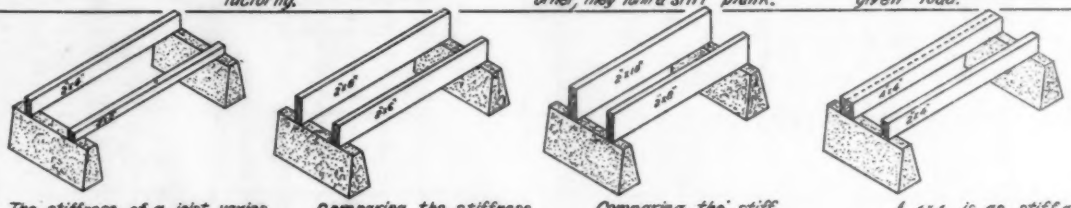


A plank on edge is much stiffer than the same plank lying flat.

A plank on edge would make a poor diving board, while the same board used flatwise might bend satisfactorily.

A bunch of thin slats bend easily, but if the same slats are glued or bolted so that they cannot slip on each other, they form a stiff plank.

A 2x2 is 8 times as stiff as a 1x2. That means that the 1x2 bends 8 times as much under a given load.

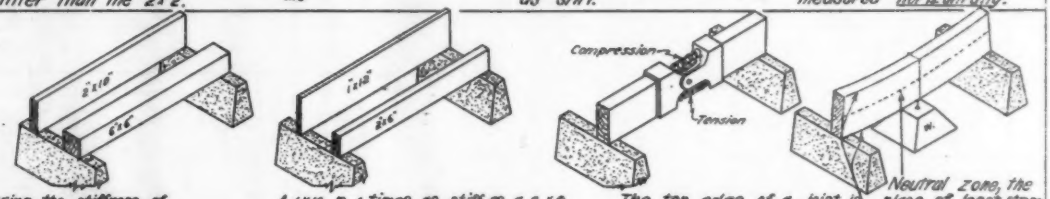


The stiffness of a joist varies as the cube of the depth. $4^3 = 4 \times 4 \times 4 = 64$. $2^3 = 2 \times 2 \times 2 = 8$. Since 64 is 8 times 8, the 2x4 is 8 times stiffer than the 2x2.

Comparing the stiffness of a 2x8 & a 2x6; $8^3 = 512$, $6^3 = 216$. The 2x8 is $\frac{512}{216}$ times as stiff.

Comparing the stiffness of a 2x10 & a 2x8; $10^3 = 1000$, $8^3 = 512$. The 2x10 is $\frac{1000}{512}$ times (almost twice) as stiff.

A 4x4 is as stiff as two 2x4's. The stiffness varies directly as the thickness of a joist measured horizontally.



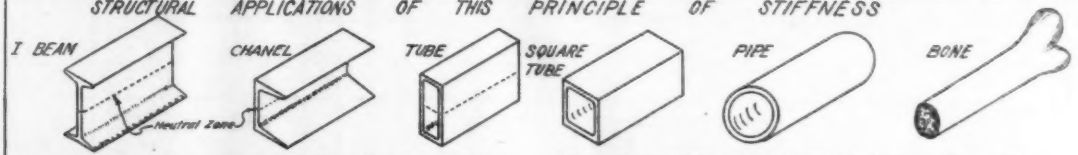
Comparing the stiffness of a 2x10 & a 6x6; $10^3 = 1000$, 6's less, but since the 6x6 is 3 times as thick, multiply 216 by 3 giving 648. Then the ratio of stiffness is $\frac{1000}{648}$.

A 1x12 is 4 times as stiff as a 2x6. $12^3 = 1728$. $6^3 = 216$. The 2x6 is twice as thick. The ratio is $\frac{1728}{216 \times 2} = 4$. However, 1" boards, for several reasons, are not practical for floor joist.

The top edge of a joist is under a stress of compression & the bottom edge under tension. As a joist bends, the top edge gets shorter & bottom edge longer.

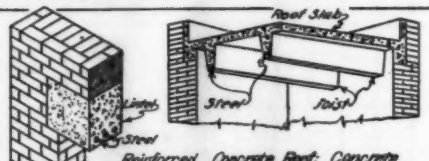
Neutral zone, the place of least stress. The center does not change in length. Points of greatest stress.

STRUCTURAL APPLICATIONS OF THIS PRINCIPLE OF STIFFNESS



Great depth gives great stiffness. There is much material at the extreme top and bottom, where the stresses are greatest, and little material in the center (neutral zone) where the stress is least.

The most economical shape to resist forces from all directions is the hollow cylinder (pipe). The bone is a good illustration of this principle. A solid rod is stiffer than a hollow one, but it is not nearly as strong for its weight.



Reinforced Concrete Roof: Concrete roofs are made with deep joists to give great strength. Since concrete is not strong in tension, reinforcing steel must be used at the bottom.

Corrugated iron is a great many times stiffer than flat sheet iron.

Note:

We have seen that a 2x4 joist is 8 times as stiff as a 2x2, i.e. 8 times the weight is required to bend a given amount. But a 2x4 cannot be bent nearly as much as a 2x2 without breaking. Then a 2x4 is not 8 times as strong as a 2x2 even though it is 8 times as stiff. The strength of a joist varies as the square of the depth. A is $2^2 = 4$. The 2x4 is $\frac{8}{4}$, or, 4 times as strong.

DESIGNED-H.R.R. TRACED-A. FRENCH

Submitted by H. H. Robinson, Augusta, Kansas

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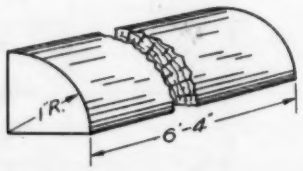
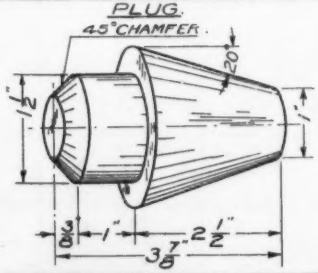
FREEHAND SKETCHING | DIMENSIONING. | No 13

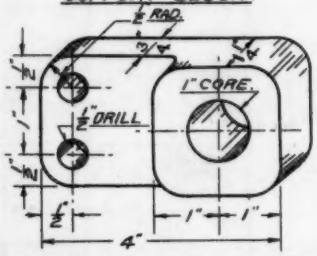
MOLDING.



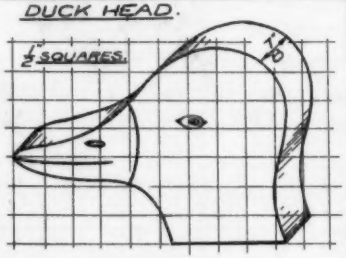
PLUG.



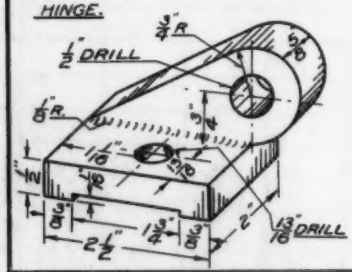
SUPPORT BLOCK.



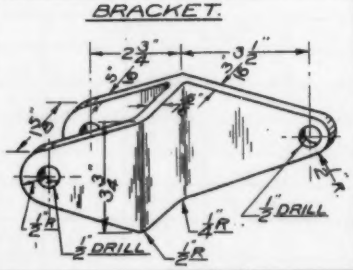
DUCK HEAD.



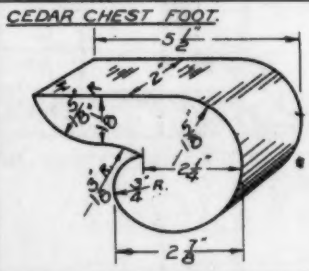
HINGE.



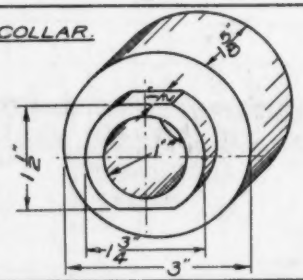
BRACKET.



CEDAR CHEST FOOT.



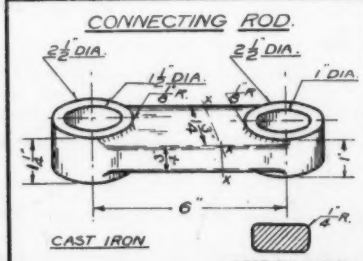
COLLAR.



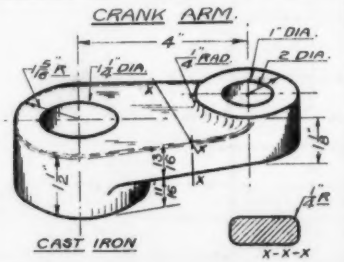
Submitted by Jonathan Bright, Erie, Pennsylvania

FREEHAND SKETCHING | SECTIONS. | No 14.

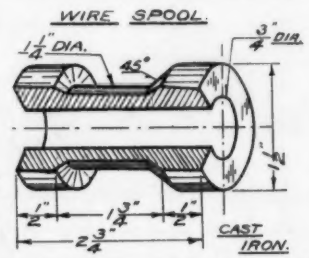
CONNECTING ROD.



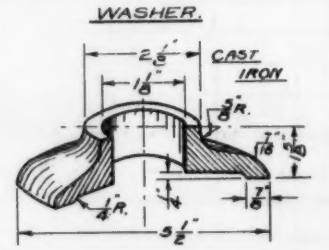
CRANK ARM.



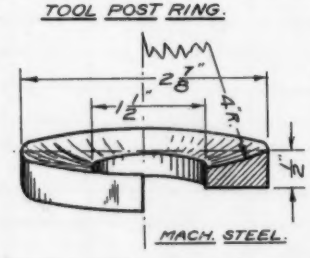
WIRE SPOOL.



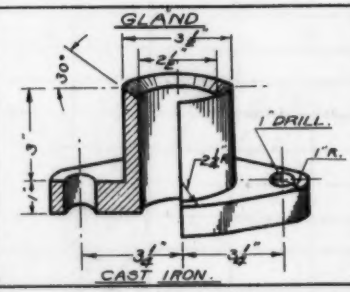
WASHER.



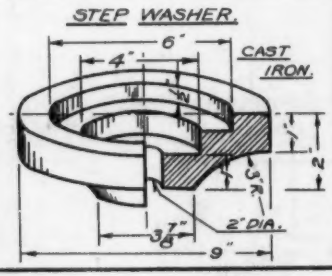
TOOL POST RING.



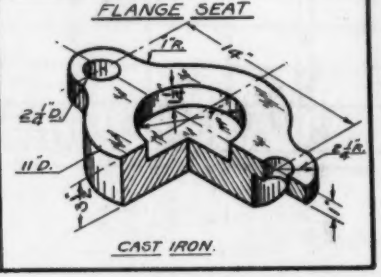
GLAND.



STEP WASHER.



FLANGE SEAT.



Described Elsewhere in This Issue

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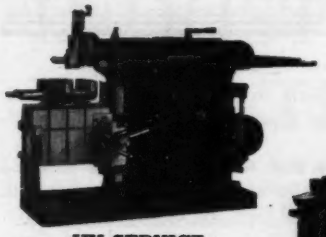

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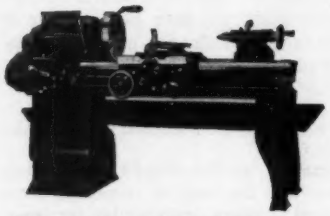

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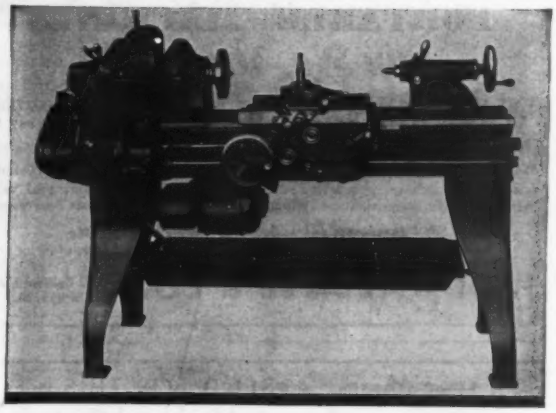

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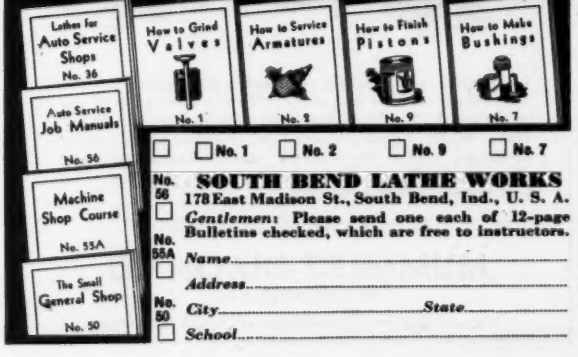

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New Publications

Model Sail and Power Boats

By Claude W. Horst. Cloth, 96 pages, 9 by 12, illustrated. Price, $2. Published by The Bruce Publishing Company, Milwaukee, Wis.

This book, written by a man who has built and designed full-sized sail and power yachts as well as many models, will be welcomed both in the school shop and by the home crafter.

The subject is concisely, yet exhaustively treated, and covers not only a unique method which greatly strengthens the entire construction of the model, but also outlines the equipment and material needed and the method of finishing the completed model.

Nine power-boat models and two sizes of sailing sloops are so ably described that the builder will have little trouble in producing very presentable models. There are numerous illustrations and a number of plates.

Vocational Guidance

Cloth, 385 pages, 6¼ by 9¼. Price, $3. Published by D. Appleton-Century Co., New York City.

This report of the Subcommittee on Vocational Guidance deals in quite a comprehensive way with the study of counseling, occupations, placements, curriculum guidance, opportunities for training, and the special problems of the Negro and the Indian.

It is based on the results obtained from extensive questionnaires directed to the public and parochial school system of upward of 150 cities, and to state departments of labor and other social and employment agencies. It contains an extensive bibliography of occupational pamphlets.

Practical Electricity

By Terrell Croft. Cloth, 688 pages. Price, $3. The McGraw-Hill Book Company, New York, N. Y.

This is the third edition of a book that has become deservedly one of the most popular beginner's books in high-school and prevocational shop classes in electricity. The present edition includes an entirely new chapter on vacuum tubes, and discussions of the newest findings on the theories of the composition of matter and electrons.

Industrial Education

The Fordson public schools, city of Dearborn, Mich., has issued the third edition of their *Industrial Education* manual. It contains the outlines of a large number of industrial-education courses on the senior-high-school level. This material was prepared under the supervision of A. C. Tagg, director of industrial education. A copy of this 191-page book may be obtained for 25 cents, plus postage.

Industrial-Arts Courses for Junior High Schools

State Teachers College, Santa Barbara, Calif., has developed courses in general metal work, concrete construction, mechanical drawing, electricity, and woodwork under the direction of E. E. Ericson. These outlines contain the objectives of the course, suggestions to teachers, lists of projects, and procedure. They may be obtained from the State Teachers College, Santa Barbara, for 25 cents a course.

Industrial Education Films

By L. L. Gore. Published by the Industrial Education Department of George Peabody College, Nashville, Tenn. Price, 50 cents.

The booklet is intended to disseminate information relating to the source and use of visual education as related to industrial education and the industries. The user of projection apparatus will find in this booklet much information of value and interest regarding related industries. The material is in the form of a monograph, containing a list of films with the cost, width, number of reels, description, and place from which each film may be obtained.